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TRANSACTIONS

OF THE

SCOTTISH ARBORICULTURAL SOCIETY.

SECRETARY AND TREASURER,
JOHN M'LAREN, JUN.,
FELLOW OF THE BOTANICAL SOCIETY, EDINBURGH.

VOL. XI.

EDINBURGH:
PRINTED FOR THE SOCIETY.
SOLD BY DOUGLAS & FOULIS, CASTLE STREET.
1887.

LIBRARY NEW YORK BOTANICAL GARDEN

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The Society, as a body, is not to be considered responsible for any statements or opinions advanced in the several papers, which must rest entirely on the authority of the respective authors.

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SCOTTISH ARBORICULTURAL SOCIETY.

I. *Address delivered at the Thirty-first Annual Meeting.* By Hugh Cleghorn of Stravithie, M.D., LL.D., F.R.S.E.

Gentlemen,—I find myself called upon, at a time of unusual pressure, to say a few words to my old friends at their annual meeting. I rejoice to see many known faces, and to find so many fresh recruits joining our ranks, and distinguished strangers appearing amongst us this day. Being aware that a large proportion of the country members are anxious to adjourn to the Forestry Exhibition, I shall compress my remarks to the shortest possible length.

It is becoming that I should first notice the absence of our dear lamented friend and ex-President, *Emeritus* Professor Balfour, who so often welcomed us to this class-room, and whose venerable countenance was never absent from our annual gatherings. He spent a long, laborious, and useful life in this city, and has been called to rest with his fathers.

When we met last year, we were looking forward to the probability of the Forestry Exhibition taking place, and I have to congratulate you on the fulfilment of the project. The Marquis of Lothian, our late President, in his address at the opening of the Exhibition, gracefully alluded to our Society when he gave it the credit of having first proposed the Exhibition. We are, of course, deeply interested in the results that may flow from this great undertaking; these are still in the future, but we know that the progress of our work is being keenly watched by all who have the least acquaintance with Forestry in this as well as in other lands.

Such an Exhibition as this has of necessity engrossed the

energies of many, and not a few of our members have been fully occupied in preparing and maturing plans for it; and I myself must crave your indulgence on this head.

The ground on which the Exhibition Galleries are erected is about 5 acres in extent. The main building is 650 feet long by 55 feet broad, with three transepts, each 150 feet long by 55 feet broad, with a high central dome in each transept. The design of the buildings is similar to the main galleries in the Health Exhibition, Kensington. Additional annexes, 500 feet long and 25 feet broad, similar in design to the main buildings, were erected at a later stage in consequence of the large demands for space by the Japanese Government and others; the exhibiting area thus became one-third larger than originally planned. The building is entirely of wood, and is of a handsome light design, which produces a very agreeable effect on entrance, and is generally admired.*

The electric railway runs along one side of the building, and is about 650 yards in length. On the west side of Donaldson's Hospital grounds a field about 7 acres in extent was inclosed for the purpose of exhibiting wood-working machinery in motion, nurserymen's exhibits, greenhouses, iron houses, wire fencing, gates, and articles of a like nature. Here will also be found various châlets, including one constructed entirely of Scots fir from Balmoral, and another of the Californian redwood; also the Manitoba Settler's Farm, and many varieties of models of gates and fences, with fencing materials and implements, exhibited by the Commissioners of Her Majesty's Woods and Forests, all having a connection with the wide subject of forestry.

It is to be regretted that some countries, particularly France, Germany, and the United States, which yield a large amount of timber and forest produce, did not respond to the circular invitation of the Executive Committee. France at the time was much occupied with troubles in China and Madagascar; and other Governments, such as Persia, Chili, Venezuela, and Honduras, were prevented by various causes from sending contributions. Where direct participation, in so far as exhibits are concerned, has been impossible, official maps and publications bearing on the forest service or literature of the country have been forwarded, or a representative has been commissioned officially to attend, or the

* *See* Plan of the Buildings and Grounds; and also Plates I. to IV. Plate I.—Front View of the Exhibition Building: Plates II., III., and IV.—Views illustrating the sections of the Scottish Arboricultural Society's Court.

efforts of private individuals have been exerted to supply the omission. The Exhibition has thus been inaugurated by the co-operation of many of the foreign and colonial Governments, and by the good wishes of all.

In the arrangement of the articles exhibited, the geographical principle has been adopted, the goods of each country being placed together. It was determined to arrange the space in courts, with the hard objects in the centre, and the soft goods and illustrations requiring vertical space on the walls and sides.

A scientific arrangement was very desirable, and the "Classification" issued by the Executive Committee was carefully prepared with that intention, but it was found impossible, owing to various causes, to arrange the Catalogue in accordance with it—(1.) from the imperfect details given in many of the schedules of exhibitors; (2.) the tardy arrival of the consignments; (3.) the time allowed was too short; and (4.) the objections of Commissioners of countries occupying small space to allow their contributions to be divided. Great latitude has been allowed in the admission of goods, which have been largely received during the month since the opening; and the very large and interesting collection from Japan has been scarcely three weeks in its place.

The Catalogue (1st edit., 1st July) contains much valuable information, especially the portion relating to India and the Scottish Arboricultural Society. A second edition was published on 21st July, with running numbers and an index, to assist the Jurors in their labours, but it is not yet complete with respect to several colonies and foreign Governments;* the list from Japan, it is hoped, may yet be printed, being very valuable.

The Scottish Arboricultural Society has in its court about 150 exhibits, and about 20 outside, making a total of about 170, the arrangement of which reflects great credit on our Secretary, Mr M'Laren, who spent his annual holiday in our service, and has been constant in his attendance. Other members have also rendered valuable help. Our Scottish foresters have come forward from almost every district of Scotland, with the enthusiasm we expected, and when the Jurors' awards are made public, the value of their contributions will be fully recognised. The result is most gratifying, and shows their efforts to raise the position of Forestry to the highest standard in this country.

* Catalogues of the Exhibits of India, British Guiana, the Cape of Good Hope, and Ceylon, were printed by the Commissioners of these countries.

India.—The Indian collection occupies the south central transept, and several bays on each side; it is very large and interesting, occupying an area of 5000 square feet; the Catalogue has a historical preface by Sir George Birdwood, describing the first beginning of Forestry in India. The arrangement of the collection is admirable,—the Commissioner, Colonel Michael, and his assistant, Mr Cole, having had previous experience in the Paris, Vienna, and Amsterdam Exhibitions. A special Report will be published.

The Index Collection of Timbers sent by the Government of India comprises 800 specimens, with their habitats and commercial uses, and illustrates arboreal vegetation from Tibet to Cape Comorin; each specimen is carefully labelled and branded with a corresponding number referring to Gamble's "Manual of Indian Timbers."

In the Indian Court may be specially noticed the very valuable series of maps and diagrams executed by the Forest Survey Department under Major Bailey, R.E., who himself arranged them in an instructive manner. The excellence of these topographical surveys can scarcely be overrated in connection with the demarcation and management of the reserved forests divided into blocks or compartments, and in the case of boundary disputes their value is undeniable. For students of forestry this is a most important feature of the Exhibition, and shows the silent progress of the great work which has been carried on by Dr Brandis and others during the past twenty-five years.

Another country which exhibits maps showing in detail the general distribution of forests, is Denmark. There are three sheets displaying the occurrence of the forests of conifers and of broad-leaved trees, also the extent of newly-planted areas and the geological formations on which they grow. There are also maps of the forest district of Kronborg, which resemble those made in Germany, and are very neatly executed.

Othar Holnboe, custom-house surveyor, Christiania, furnishes a map representing the principal woods of Norway, and the export of forest produce from the different parts of the country to Britain and other countries. Robert Bell, LL.D., Assistant-Director Geological Survey of Canada, exhibits a large map showing the distribution of the forest trees of Canada.

The Government of Japan displays a chart illustrating the natural distribution of forest trees in Japan, and marking certain zones, each indicated by a particular tree, which forms a prominent

feature in the landscape. The extent of these zones is marked in colours on the map. There are also excellent coloured drawings, representing the habit of these fine trees, and their foliage, flower, and fruit in life-size.

It would have been very desirable that similar illustrative maps had been furnished, as far as possible by various Governments, to assist in determining the rates of growth of valuable trees in different countries. For instance, in the Danish collection some of the diagrams give the mean height from 20 to 120 years, and show that in Germany the height of beech and spruce is greater than in Denmark; but the average diameter of the latter exceeds that of the former.

Japan.—The Japanese Court occupies the eastern transept, and forms one of the largest and most important sections. The arrangements by the Commissioners (whom we have the honour of seeing amongst us to-day) have been carried out in a most thorough and business-like manner. They knew beforehand the exact amount of space their goods would occupy, and worked with a rapidity and skill which might put to shame the most advanced nations. The Japanese collection was catalogued before it was despatched, and the arrangement corresponds with the running numbers, and is most creditable. Mr Takei, the head Commissioner, has shown himself possessed of great business capacity, as well as being an expert in the science of Forestry.

The importance of Forestry to the welfare of Great Britain and its Colonies has only been recently recognised by us, but in Japan it has long formed an important feature of national education.

The sections of woods, numbering about 270, are placed on the central table, with botanical specimens and illustrations above, and manuscript notes below, containing the Japanese and botanical names, with the habitats and economical uses, the comparative rarity or abundance of the tree, the average height at 50 years and at maturity. Each section, drawing, and description is marked with a corresponding number.

Numerous models and drawings illustrate the expedients adopted for felling trees, slipping and floating the logs down narrow gorges or deep chasm rivers, and the booms for catching and collecting timber when the rivers debouche on the plains, and where timber depots are formed. Illustrations are also given of the method of preventing soil from slipping away from the sides of mountains, and the method of introducing sand-binding plants. The draw-

ings are mounted in wooden frames, and tastefully decorated with fragments of veneer of different colours. The models and illustrations must prove exceedingly instructive to students of forestry.

The numerous Collections of Woods exhibited by different countries naturally come under the head of Forestry, but when dealt with by the juries of the different classes, have to be considered in reference to particular qualification for special purposes.

Woods of Construction are of three kinds, for *Civil*, *Naval*, and *Ordnance* purposes, and their value is affected by such material qualities as *Strength*, *Toughness*, *Weight*, *Durability*, and *Elasticity*.

Of woods adapted for purposes of construction, the principal collections in the Exhibition are from New Brunswick, Norway, Denmark, India, Ceylon, Andamans, Johor, British Guiana, and Japan. Many of the timbers, as in New Brunswick, Norway, Denmark, India, and Ceylon, are well known and commonly used, but in looking over the catalogues received from South Africa, Sierra Leone, Johor, and Japan, we often find only the native names and short descriptions of woods used and valued in the countries to which they belong, but in many cases quite unknown in Britain, and of the comparative merits of which the natives themselves are frequently ignorant.

It is true that much has been done by the numerous national exhibitions to extend technical knowledge; and especially the botanical identification of those plants yielding forest produce has been greatly advanced at Kew; while important experiments on the strength and resistance of various woods have been carried out by Dr Brandis * in Calcutta (1864), and by the late Captain Fowke † in London. But it is evident that in some parts of the world much still remains to be done, and the vast collections now brought together will afford opportunities of placing specimens in comparison with each other and with the ordinary woods used in trade and construction.

There is a great deal of value to the country in this Exhibition, not only to landed proprietors, foresters, architects, and engineers, but also to joiners, upholsterers, and cabinetmakers. It appears to me that it would be of great importance in an industrial point of view to educate the eye and mind of the artisans in our large towns by showing and explaining the principal objects here exhibited. Organisations might be formed in—say Glasgow, Dundee,

* Gamble's Manual of Indian Timbers, 1881.

† Report on Paris Exhibition, 1856.

Aberdeen, and other places, to arrange for large parties coming for one or two days. I am often surprised by the questions put to me by intelligent workmen visiting the building, who are evidently seeking information, and it is my belief that much useful knowledge may be communicated to all classes of the people.

There is little doubt that the present Exhibition will give an impetus to a more systematic forest education both in Scotland and elsewhere. Improved tools, instruments, working plans, valuation surveys, and the like, will be introduced. In these days our foresters must take care that our Continental neighbours do not outstrip them in the march of improvement and in general details relating to production of timber, economy of management, and despatch of business. In some European countries the education and training of foresters is of a highly scientific character, and the whole wooded area has been managed for centuries with systematic care and skill.

The authorities of the India Office have decided, after much consideration, to discontinue the system of training on the Continent our young men for Forest service, and henceforth the resources within our own borders will be utilised for the education of Forest candidates. The Royal Engineering College, Cooper's Hill, Staines, is the place selected in the first instance, where a thoroughly good teaching staff already exists; and the proximity of the Royal Gardens at Kew will be of great advantage to the students.

As the Marquis of Lothian well remarked at the opening, we have in Edinburgh many concurrent advantages—the University, the Botanical Gardens, the Arboretum, and the Highland Society. One thing only is needed in addition—a tract of forest reserved for systematic management and professional instruction.

There will be a great mass of valuable material at the close of the Exhibition which should be utilised in Edinburgh for purposes of instruction; and our long desired hope for a Forest School may be one result of this movement. In this way the recommendation of the French Professors of Forestry, who visited Britain two years ago, would be carried out; and as a result of the International Exhibition, we should have the establishment of a Forest School in Edinburgh.

Before leaving this subject, I desire to allude to the presence among us this day of several Indian Forest officers,* three of whom have been students at the Ecole Forestière, Nancy. And I am sure

* Messrs Shuttleworth, Fry, Fuchs, and Wroughton.

that in this case, as in so many others, further acquaintance has only heightened esteem. They have ungrudgingly given their aid as jurors at the Exhibition; and I have been delighted to observe the continuous and fraternal co-operation of Scotland and India.

The work of the juries is nearly completed, and the awards will be known in a few days. Such names as Sir J. D. Hooker, Dr Lyons, M.P., Colonel Moncrieff, R.A., Professors Wilson, Fraser, Cossar Ewart, and Dickson of Edinburgh, Bayley Balfour of Oxford, Professor Archer, Industrial Museum, Professor M'Nab of Dublin, Trail of Aberdeen, M'Intosh of St Andrews, and a corresponding number of our best and most honoured members,—this selection and combination, effected with great care, will give a judgment based upon technical knowledge, commanding the confidence of the public.

The Executive Committee have arranged for a course of lectures during August and September; and several distinguished professors and experts have kindly consented to enlighten us on various interesting topics. Dr Lyons, M.P., has already addressed us "On Forestry in Europe and America," and Professor M'Nab "On a Piece of Wood and its Teaching;" while further instruction awaits us from Mr Jack, on "The Forest Resources of New Brunswick;" Professor M'Intosh, on "Timber-boring Mollusca;" Major Bailey, R.E., on "Forest Surveys in India;" Dr Howitz of Copenhagen, on "Eucalypts at Home and Abroad;" Mr Meldrum, on "The Forests of Johor;" Dr Croumbie Brown, on "The Aridity of Spain;" and Mr Baty, on "The Management of Plantations in Cumberland."

In conclusion, it may not be out of place to allude to the importance of many of the books and pamphlets on Arboriculture received in connection with the Exhibition. *Britain* has sent 38 vols., including 12 works on Forest Science from the fertile brain of Dr J. Croumbie Brown; *India*, 2; *Singapore*, 1; *British Guiana*, 1; *South Australia*, 6; *United States*, 13; *Denmark*, 24; *Norway and Sweden*, 2; *Germany*, 20; *France*, 13; *Italy*, 8—Total, 129 books and pamphlets.

When the Exhibition is over, by request of the authors, the more valuable of these works will be transferred to our library, and they will form a most acceptable addition to our store of Forest literature.

Amongst many notices of the Exhibition a series of articles in the *Gardeners' Chronicle*, detailing the general contents of the several courts, is in course of publication.

II. *The Woods of New Brunswick: Being a Description of the Trees of the Province available for economic purposes, prepared by order of the Hon. James Mitchell, Surveyor-General of New Brunswick, for use at the International Forestry Exhibition at Edinburgh in* 1884. By L. W. Bailey, Ph.D., Professor of Natural History in the University of New Brunswick; and Edward Jack, C.E., Surveyor of Crown Lands.

Newfoundland and the Maritime Provinces of Canada are, of all new colonies, the nearest to Great Britain. The extensive tracts of barren land which the first contains, and the habits of its inhabitants which are those of fishermen, forbid the expectation of a large timber yield from it. New Brunswick, however, which has in its interior a vast extent of fertile land covered by virgin forests, consisting largely of birch, maple, beech, and other hard woods of large size and excellent quality, stands ready to furnish these in any desired quantity or form (as well as soft woods of different kinds) so soon as the necessities of British commerce and manufactures demand it.

The Pine and Fir Tribe (*Abietinæ*).

The representatives of this tribe in New Brunswick are—(1.) The White Pine; (2.) The Red or Norway Pine; (3.) The Grey or Northern Scrub Pine; (4.) The Hemlock Spruce; (5.) The White or Single Spruce; (6.) The Black or Double Spruce; (7.) The Balsam Fir; and (8.) The American Larch, Tamarack, or Hackmatac.

1. the white pine (*Pinus strobus*, L.).

The white pine is one of the largest, tallest, and most stately trees in the New Brunswick forest, often rising in a single straight but tapering column to a height of 80 feet or more, in rare instances to over 120 feet.

The several varieties, distinguished locally as "Pumpkin Pine," "Sapling Pine," and "Bull Sapling," owe their origin to a slight difference in the colour, texture, and specific gravity of the wood, dependent upon corresponding differences in the condition of their growth. The first named is found most thickly near the shores of streams, or on hill sides fronting lakes or streams, seldom

extending in any quantity further than half or three-quarters of a mile from water.

When found in the forest distant from streams or lakes, the pumpkin pine as well as the bull sapling occur in small groups, or in pairs or solitary, a considerable distance often intervening between groups or individuals. Sometimes a single tree may be seen towering to the extreme height of its species on some rocky and elevated hill, in places so difficult of access that the lumbermen, after felling them, either float them from their place of growth to where they can be more conveniently managed, or remove them with the aid of ropes and blocks, with or without the assistance of horses and sleds. The soundest and best pumpkin and bull sapling pines are found scattered on high land, and frequently surrounded by hardwoods. Such as grow in low and swampy land are very subject to shakes and concave knots. These varieties of large size have become so scarce in the Province of New Brunswick, that the lumbermen often cut roads half a mile or more in length to reach a choice tree. Nearly all are found on the dry and sandy soil of the coal measures, covering the low ridges, and surrounding the heaths and bogs which abound on the surface of this formation.

The great fire of Miramichi, in the year 1825, and the Saxby gale a few years ago, have done millions of dollars damage to the pine lands of New Brunswick, and the day is not very distant when pine trees of good size will be obtained with difficulty in the Province.

This valuable wood is used for so many purposes, that an enumeration of them would be almost impossible. Among its more uncommon uses may be named that by the moulder for patternmaking; it is very applicable for any purpose which requires a wood easily worked and durable.

2. THE RED PINE (*Pinus resinosa*, Ait.).

"The Red (or Norway) * pine has an erect trunk, taller and more slender than that of the pitch pine, which it most nearly resembles. The bark, which is much less rough, is in rather broad scales of a reddish colour. The long leaves are in twos, and the cones are free from the bristling, rigid, sharp points which distinguish those of the pitch pine. It may also be distinguished at

* "Wrongly called Norway Pine" (*Asa Gray*).

a distance by the greater size and length of the terminal brushes of leaves."—*Emerson.*

Lumbermen are acquainted with two varieties, which they denominate by the names of the Sapling and Old Red Pine. The former is an inferior wood, generally having those niches of sap which rot quickly on exposure to the weather. It has been largely used in the State of Maine for hogshead heading, for which purpose it answers well. The old red pine, now nearly extinct here, sometimes attains the height of 90 feet and a diameter of 3 feet, the trunk being nearly uniform and without branches for a height of 40 or 50 feet. The wood is strong and durable, resembling that of pitch pine, but with less resin, and was formerly largely employed, like the latter, for the decking of vessels and for beams, having a fine compact grain with few knots. It grows as a scattered tree on dry and sandy soil; some of the best trees ever obtained in the Province were cut on the granite boulder district which crosses the New Brunswick railway about fifty miles north of St Andrews. The Tobique river traversed a tract which was once a great habitat of the old red pine, especially that branch called the Wapskyhegan, on whose banks it grew abundantly, and the trees stood so close on the ground that there was hardly room to turn a sled between the stumps. The axe and fire have now, however, completely removed them from this locality.

3. GREY OR NORTHERN SCRUB PINE (*Pinus Banksiana*, Lamb).

This tree is readily distinguished from the other species of pine by its scrubby growth, and by the colour and appearance of the peculiar scales by which the trunk is covered, and by its singularly spreading boughs, as well as by the cones which hang under them. Timber made from it in former times, when it was tolerably abundant, was considered to be of good size if it averaged three-quarters of a ton to the tree. The wood is hard, full of pitch, and free from sap, but it is apt to be full of streaks. It is much used by the Intercolonial railway for ties and railway sleepers, being one of the best woods for this purpose.

Certain sections of country on the South-West Miramichi, the forests on which were destroyed by the great fire of 1825, have since become so thickly covered by forests of Banks' pine that it is almost impossible to press one's way through the trees. It grows also extensively on the Little South-West Miramichi.

4. THE HEMLOCK SPRUCE (*Abies Canadensis*, Mich.).

The hemlock spruce, or hemlock as it is often more simply termed, is one of the most abundant of our evergreen trees, being found on almost every soil. It is when in perfection a very beautiful tree, but is apt, as age advances, owing to the death or breaking off of the lower limbs, to assume the appearance of premature decay. Under favourable circumstances it reaches a height of 70 or 80 feet and a circumference of 6 to 9 feet, the latter, as in others of the family, being nearly uniform until the branches are reached. There are two varieties known to woodsmen, the Sapling or White Hemlock, and the rough bark or Black Hemlock. The latter, owing probably to its large and heavy top, is very subject to shakes, rendering the boards sawn from the lower log nearly worthless. The wood of the sapling or white hemlock, with the exception of a small piece near the butt, is sound and firm, and lasts well. It is of more frequent occurrence in the southern or middle districts of New Brunswick than in the north, being a rare tree north of the Grand Falls of the St John. It occurs in belts and masses in certain localities, the laws regulating its place of growth not being understood. It is very subject to the action of fire, and disappears rapidly from the neighbourhood of settlements. It was formerly abundant on the lower portion of the Nashwaak, while it is rarely found above the Narrows, forty miles from the mouth. It is abundant on the Intercolonial railroad north of Moncton.

A wide belt of hemlock crosses the St John river on the granite formation forty miles above Fredericton, and the wood is especially good, owing, perhaps, to the presence of potash from the decomposition of the felspar contained in the granite, by the action of time, frost, and moisture. It is found in large quantities and of good quality on the lands of the New Brunswick Land and Lumber Company south of the Becaguinne river, growing on the red soil of the Lower Carboniferous formation. This wood has been used hitherto for framing and boarding in buildings, and for fencing; it is now employed to a limited extent for interior finishing of houses, and is better than black spruce for many purposes: it does not warp or shrink more, or indeed probably so much, as good white pine; it requires a longer time for seasoning than either pine or spruce; it holds nails well; and much of it has a fine grain, and takes an excellent polish. It is very durable

when not exposed to alternations of drought and moisture, and is said to be impervious to the attacks of rats, and therefore used in the construction of granaries. Were its good qualities better known, its use would be more general.

5. THE WHITE OR SINGLE SPRUCE (*Abies alba*, Michaux).

This tree is larger and more slender than the black spruce, being distinguished by the lighter colour of its bark and leaves. On the Restigouche, Upper St John, and many other places, it grows to a great height with little taper. Mr J. A. M'Callum, Deputy Surveyor, in 1873, had a tree cut down on the former stream above the Quatamkedguick, which made a log measuring 14 inches at the butt, 10 inches at the top, and was 64 feet long. They have been cut 80 feet long, measuring 25 inches in diameter at the butt, and 18 inches at the top.

White spruce is found in valleys, growing to a very large size, skirting streams, and in small clumps on the sides and tops of hills. The yield of white spruce land will not compare with that of black, as the former tree is much more scattered in its growth. The wood is white and soft, and generally free from knots. Its specific gravity is less than that of the black spruce, to which it is inferior in strength, and exhibits less elasticity. The spruce deals shipped from the Nepisiguit and Restigouche rivers are nearly all manufactured from this tree.

6. THE BLACK OR DOUBLE SPRUCE (*Abies nigra*, Michaux).

As an article of export, this is the most valuable tree of New Brunswick. The vast forests of black spruce which once covered the Province have been reduced by fire and cutting to less than one-third of their original extent. This tree was found in greatest abundance in the southern part of New Brunswick. A line drawn from the first Eel River Lake, extending north-east to the dividing ridge between the Little South-West Miramichi and the Nepisiguit, is about the boundary of the great black spruce lands of the Province. South of this line vast forests of it extended from the Schoodic, crossing the Nashwaak and South-West Miramichi, thence to the north-west branch of the last-named river, where it ended. North of this line the tree growth is generally hardwood, largely mingled with firs. Such spruce as occurs along the shores of streams or scattered on the hill sides is principally of the white variety.

Black spruce is commonly found in thick masses around lakes, or about the base and sides of ridges whose summits are covered by hardwoods, the spruce thinning as the elevation increases. Like the white pine, it attains its greatest size and altitude when growing among surrounding hardwoods. During the past seven years vast quantities of this tree have died, either from the effects of disease, or from the attack of an insect, which eats its way between the sap and the bark; the *uncut* forests have suffered most. The distinguishing properties of the wood are strength, lightness, and elasticity. That found on the shores of the Bay of Fundy is remarkable for its toughness and durability, and is thought to be nearly equal to Hackmatac for shipbuilding. It furnishes as fine yards and topmasts as any in the world, and has been long and extensively used for this purpose.

Heretofore the smaller trees have been largely exported from the head of the Bay of Fundy in round logs, to be used as piles for wharf-building. The principal root and the lower part of the trunk are extensively used for shipbuilding, constituting knees and foot-hooks; and by means of the small fibrous roots the Indians of Maine and New Brunswick sew together pieces of birch bark to form the exterior covering of their canoes.

Very superior clap-boards are made from the clean butts of these trees, because the wood has straight seams from the butt almost to the branches. In many localities black spruces are very seamy. This occurs sometimes on the low lands, but oftener on the ridges, and is probably caused by the joint effect of wind and frost. A cheap variety of shingles is obtained from small trees. Their value, however, to New Brunswick arises from their furnishing the major part of the deals and battens which are exported to Great Britain and other countries. The manufacture of spruce deals commenced in 1819, and has been steadily increasing.

7. THE BALSAM FIR (*Abies balsamea*, Marshall).

This tree, also known as the Fir Balsam or Silver Fir, is common in New Brunswick, being found in nearly all localities, but in the greatest abundance and in the most compact bodies on the head waters of the St John, Restigouche, and Miramichi rivers. There is an extensive forest between the heads of the Miramichi and Tobique rivers. It grows here very thickly, and some acres have 10,000 or 12,000 feet to the acre upon them (superficial measure). The wood is apt to be defective, but in

this locality it is better. Mr Braithwaite, a well-known New Brunswick woodsman, says that the first 10 to 20 feet of the firs growing here are generally free from knots; his attention was drawn to their soundness when cutting into them for hunting or camping purposes.

The wood is rich in resin, or rather in turpentine, which is contained in small vesicles or tumours covering the trunk and limbs. This is usually known by the name of Canada balsam, and is employed in medicine for pulmonary complaints, and in art for the manufacture of varnish.

This fir is a lasting wood, and seasons readily. It is easily worked, and is used in the manufacture of butter firkins and other wooden vessels for holding food, as it imparts no flavour. It can be used for flooring, interior doors, slats for Venetian blinds, etc., etc.; the Indians prefer it to cedar for lining their canoes, as it does not absorb water.

8. THE AMERICAN LARCH, TAMARACK, OR HACKMATAC.
(*Larix Americana*, Michaux.)

The American or black larch, called by the French Canadians Epinette Rouge, by the descendants of the Dutch, the Tamarack, and among the English, commonly by its Indian name of Hackmatac, is one of the most valuable trees of the New Brunswick forest. Its favourite place of growth and where it usually attains its greatest size, is on or near the banks of some sluggish brook, growing specially well among that variety of wild grass known as "blue joint." It generally surrounds the barren boggy heaths which abound in the middle section of New Brunswick; those trees growing on the bogs being stunted and small, while those on the edges of the heath attain a large size, and frequently afford good roots for shipbuilding purposes. The roots of those found on intervale land are, however, generally sounder and larger, though the trees are not so abundant. Many of the finest and largest Tamaracks have been found growing out of old beaver dams, and these industrious animals may claim the honour of having prepared the soil for their growth.

Where this tree has not a moist soil, its growth is very scanty and small. It is capable of ready propagation. By the artificial planting of the tree, a period of seventy years would yield timber fit for all the ordinary purposes of shipbuilding.

The wood of the larch, which is very resinous and compact, is

remarkably durable. It has been said to be more lasting in ships' timbers than oak. There are two varieties known among woodsmen, the white and the yellow, the former being much inferior to the latter in strength and durability.

Tamarack is largely used in shipbuilding for timbers, knees, beams, etc., but large roots and timber have become scarce, and cannot be obtained unless at considerable expense.

In the County of Aroostook, in the State of Maine, trees of Hackmatac have been obtained from which have been made four tons of timber.

Lumbermen remark, that in almost every place where you find a very large Tamarack, apparently growing alone, by searching a few rods on either side you will find a companion of nearly similar proportions. Hackmatac planks are well adapted for floor boards and door steps, from their extreme hardness, and an infusion of the boughs and bark furnishes a good alterative for horses.

The Cypress Tribe (*Cupressinæ*).

The only representatives in New Brunswick of this section, marked by having a globular or ovoid *Strobilus*, instead of a true cone for fruit, are the American Arbor Vitæ, the Red Cedar, and the Juniper.

The American Arbor Vitæ (*Thuya occidentalis*, L.).

This tree, often but improperly called the White Cedar, is abundant in New Brunswick. It is met with everywhere in low grounds and swales, but especially where the soil is clayey and the drainage imperfect. The largest and best trees occur intermingled with hardwood. They grow thickest in what are called cedar swamps, forming for short distances dense forests well nigh impenetrable. When growing thickly together the wood is generally very defective and the diameter comparatively small, rarely exceeding 1 to 2 feet.

On the dry limestone hills near St John, this species forms dense thickets of beautifully pyramidal trees. It is found in greatest abundance, as well as of the best quality, on the Restigouche river and on the upper St John. Mr J. A. M'Callum, when surveying the dividing line between the counties of Victoria and Madawaska, on the lands of the New Brunswick Land and Lumber Company, observed thousands of white cedars which were

3 feet and upwards in diameter, and extended for many miles. When on the head of the Restigouche he also noticed great quantities of excellent cedar.

On the north of Tobique and on Salmon river, on the above-named company's grants, are vast tracts of hardwood, intermingled with the finest of cedar. The Crown lands on the Nictaux branch of Tobique, for many miles, are also lined with clean and straight trees of this species well adapted to the manufacture of cedar shingles or railway ties. As this stream is remarkably smooth, the trees can be conveyed by water, very cheaply, to railway communication. The Honourable Senator Ferguson, of Bathurst, says that the white cedar is much used in the eastern part of the county of Gloucester for building boats, that boards can be got from 6 to 9 inches wide for planking, and that the roots make excellent knee timbers, as they are both light and durable.

The wood of the white cedar is very soft, light and fine grained, of a reddish tint, and, like its twigs, possessed of an agreeable aromatic odour. It is readily wrought, and is also very durable, being especially adapted for fencing, and for such other purposes as necessitate frequent alternations of dryness and moisture. There is a large export of cedar shingles and railway ties from the City of Fredericton. Chests made from this wood are said to have the property of preserving furs and woollen goods from the attacks of moths, which is, probably, owing to its aromatic odour. The bark of this tree is now used in the United States for the manufacture of coarse paper for carpet lining, sheathing, etc.

Linden Family (*Tiliaceæ*).

bass-wood, or lime tree (*Tilia Americana*, L.).

Though rare, there are few more striking trees in the New Brunswick woods than the Bass-wood, or American Linden. With a tall straight and somewhat columnar trunk, sometimes as much as 80 feet in height, branching freely, and densely clothed with rich green foliage, diversified in the season by its abundant yellowish-green flowers, or nut-like fruit, it can hardly fail to attract attention; and as an ornamental tree, it is well worthy of cultivation. Its wood is also of considerable value, being soft, white, and of a fine close grain. It is very tough and pliable, and being less liable than other woods to split from extremes of temperature, is used, in preference to all others, for

making curved fronts of sleighs, panels of carriages, etc. For similar reasons it is used by stair-builders for curved ends of stairs, and for interior finishing. It is readily carved and turned, and has sometimes been employed for the figure-heads of vessels. Its inner bark, or *liber*, is tough and fibrous, and is well adapted for the manufacture of rough ropes and cordage. It occurs sparingly on the fertile lands of the Upper St John river.

The Soap-Berry Family (*Sapindaceæ*).

The representatives of this family in New Brunswick belong to two sub-orders, of which the first (*Sapindaceæ* proper) is represented by the introduced Horse-chestnut, much prized as an ornamental tree; and the second (*Acerineæ*) by the different species of Maple. The latter only require notice here.

WHITE OR SILVER MAPLE (*Acer dasycarpum*, Ehr.).

This is a somewhat smaller tree than the Rock Maple, and less generally distributed, being apparently wanting in the northern counties, and elsewhere confined to the borders of streams. It is not uncommon among the creeks and islands of the St John river, and is often of considerable size and beauty. It yields a soft white wood, fine grained and easily worked, but with little strength or durability. It is rarely used, except in the manufacture of agricultural implements.

RED OR SWAMP MAPLE (*Acer rubrum*, L.).

This tree is, among the maples, second only to the rock maple in size and in the value of its wood. Though not strictly confined to swamps, it flourishes best in low wooded swales, and where there is abundant moisture; attaining, sometimes, under these circumstances, a height of 60 or 70 feet. It has been observed in all parts of the Province, being readily recognised in spring, from the reddish or crimson colour of its recent shoots, and in autumn from the intense brilliancy of its variegated foliage.

"The wood of the red maple is whitish, with a tint of rose-colour, of a fine and close grain, compact, firm and smooth, the silver grain lying in layers very narrow and close, and the pores being very small. It is well suited for turning, and takes a fine polish; is easily wrought; and serves for a great variety of pur-

poses. It is much used for common bedsteads, tables, chairs, bureaus, and other cheap furniture. In building it is an excellent material for flooring, and may be used for any part not exposed to dampness. It lasts well in the flat of a ship's floor, and has sufficient elasticity to serve as oars, which are almost equal to those of white ash" (Emerson's Report, p. 486).

There is a considerable quantity of this wood growing on the lands of the New Brunswick Land and Lumber Company on the St John river. It occurs on the edge of low land, but does not grow thickly in any place.

ROCK OR SUGAR MAPLE (*Acer saccharinum*, L.).

This is the largest and finest of the maples, and is the most valuable in its economic applications. Though varying greatly in aspect according to the special conditions under which it has grown, it is in all cases a remarkable and sometimes even a majestic tree, beautiful alike for form and foliage, the contour of the leaf being remarkably graceful. It is partial to rich, deep, and gravelly loams, and, except directly along the seaboard, is a very common upland tree throughout the Province. Its ordinary height is 50 or 60 feet, though rising sometimes to 70 or 80 feet.

It is of rapid growth and capable of ready cultivation, but when in open ground and unprotected is rather easily overthrown and subject to somewhat premature decay. "For purposes of art," says Emerson, "no native wood possesses more beauty, or a greater variety of appearance than that of the rock maple. It is hard, close-grained, smooth, and compact, and capable of taking and retaining an exquisite polish. The straight-grained or common variety has a resemblance to satin wood, but is of a deeper colour. The variety called curled hard maple, caused by the sinuous course of the fibres, gives a changeable surface of alternate light and shade, exhibiting an agreeable and striking play of colours. But the most remarkable variety is the Bird's-eye Maple. This is so called from a contortion of the fibres at irregular intervals, throwing out a variable point of light, and giving an appearance of a roundish projection rising from within a slight cavity, and bearing a distant resemblance to the eye of a bird. All the varieties, particularly the last, are used in the manufacture of articles of furniture—wardrobes, chairs, bedsteads, bureaus, portable desks, frames of pictures, etc. The straight-grained variety

is much used in the manufacture of buckets and tubs, and is preferable to every other wood for the making of lasts. In naval architecture the rock maple furnishes the best material, next to white oak, for the keel."

Rock maple grows in abundance on the St John river and its tributaries; it is found in greatest quantities from between Fredericton and Woodstock to the northern boundary-line of the Province. In the district north of the Tobique, for more than forty miles in a straight line, the explorer can travel through extremely fertile lands, the growth on which is largely composed of this tree, without meeting the habitation of man. A large quantity of sugar and some molasses or treacle are yearly made in the months of March and April, from the maple sap, which is received in troughs, holes having been bored or cut in the trunks of the trees to which a small spout is attached. The liquid is boiled down in large iron pots to the required thickness, and then sugared off. An agreeable candy is made by suddenly pouring the sap, when boiled to the proper consistency, on snow. This candy can be made in summer from the sugar by boiling it down with a little water, and using ice instead of snow as a means of sudden cooling.

The French of the county of Madawaska are the largest manufacturers of this sugar, and there is little other used in that county. In the bright warm April days the careful observer may frequently notice the common squirrel hanging tenaciously to some maple twig, occasionally lifting his head to bark angrily at the intruder. Closer observation will reveal the fact that the noisy climber is regaling himself on the delicious sap which the approach of spring is sending from the root to the branches of the tree. Many of the Provincial railroads pass through or near extensive forests of this wood, but although small water-powers abound, no manufacturing establishments for the various purposes of commerce have as yet been erected.

An important application of maple wood, especially of Bird's-eye maple, in veneers, has recently been made in the internal decoration of railway carriages, for which it is admirably adapted. Although, like other maples, it is deficient in durability under exposure, it is very strong and remarkably cohesive. As fuel its value is unequalled by any other tree in New Brunswick, and very large quantities are annually consumed for this purpose.

Olive Family (*Oleaceæ*).

The representatives of this family in New Brunswick belong to the genus *Fraxinus* or ash, of which there are four species.

WHITE ASH (*Fraxinus Americana*, L.).

This, from its large size, the most important of the ashes, is sparsely found in all parts of the Province, upon almost every variety of soil, though attaining its perfection only in rich loamy ground and in the vicinity of streams, where it obtains abundant moisture. Under favourable circumstances it rises to a height of 50 or 60 feet, with a straight undivided trunk for 30 feet, and a diameter of nearly 2 feet. It is usually scattered among other trees, rarely, if ever, forming groves.

The qualities from which ash wood derives its value are its strength, toughness, and elasticity. In consequence of these properties it is extensively employed by carriage and sleigh makers, especially for shafts and springs; in the manufacture of chair and sofa frames; for agricultural implements, as pitchforks and rakes; and for a variety of smaller articles. For the manufacture of oars it is preferred to all other woods.

THE RED ASH (*Fraxinus pubescens*, Walter).

This tree resembles the white ash, and grows in similar situations; it is probable that they are sometimes confounded. Besides being a smaller tree, the red ash is easily distinguished by the downy character of its leaves and newer branches, from which its specific name is derived. Its wood, though used for similar purposes, is less valuable. This tree is found to a limited extent east of the Grand Falls, in low fertile parts.

BLACK OR WATER ASH (*Fraxinus sambucifolia*, Lam.).

This tree is mostly confined to swamps and the muddy banks of rivers. It is common along the shores of the St John and Kennebeccasis rivers, but is in greatest abundance on the branches of the St John above the Grand Falls, especially on those of the Grand and Green rivers, the shores of the former being fringed by it for many miles. It is also abundant on the Miramichi river on the lands of the New Brunswick Land and Lumber Company—the drier the land usually the better the wood.

The wood of the black ash is used for house and church finish

ing, as well as in the manufacture of furniture. In order to polish it, the pores are filled with some substance, such as bees' wax, to close the pores; after this it takes a high polish. It varies in quality with the ground on which it grows. The best ash used in Fredericton is brought from the county of Carleton; there it attains a height of 40 feet or more, and a diameter of 2 feet. It comes into leaf very late in the season, and loses its foliage early.

The wood of the black ash, though inferior to the white in strength and durability, is nevertheless remarkably tough, and, owing to the facility with which after pounding it may be separated into strips and ribands, is especially preferred to other woods by the Indians for the manufacture of baskets, of which handsomely ornamented ones are made by the Tobique tribe.

Nettle Family (*Urticaceæ*).

Sub-order I.—The Elm Tribe (*Ulmaceæ*).

the elm (*Ulmus Americana*, L.).

Though comparatively restricted in its distribution, there are, nevertheless, few trees in New Brunswick which, when the proper conditions are accorded, exceed the elm in the length or vigour of its growth, certainly none which can compare with it for grace and beauty. On the uplands it is comparatively rare, and even when occurring seldom attains to great size, but in river valleys, and especially along the rich and level intervales * bordering the St John river and its tributaries, it is much more abundant and often large, its beautiful feathered trunks and plume-like branches serving greatly to enhance the beauty of the scenery. The stem occasionally girths 20 feet.

The wood of the elm is both strong and tough, and therefore well adapted for the making of ships' blocks, hubs of carriage-wheels, and kindred uses, though said to be inferior for these purposes to the English elm. It is also used in making the flooring of ships' decks, though difficult to work, the peculiarity of the grain requiring it to be planed crosswise rather than lengthwise. Its value in New Brunswick, however, is almost solely as an ornamental tree, quite equalling if not excelling in this respect its European relative. It is readily transplanted, hardy when in favourable situations, and of rapid growth.

* Holm in England; Haugh in Scotland.

Walnut Family (*Juglandaceæ*).

THE BUTTERNUT (*Juglans cinerea*, L.).

The Butternut is not an abundant tree in New Brunswick, being mostly confined to the southern counties and the valley of the St John river, especially above Woodstock, while it is absent from the coast, and also, according to Mr Fowler, from the northern counties of the Province. It is usually met with in rich moist lands, especially in calcareous districts, and some of these, such as Butternut Ridge, in King's Co., have received their names from its former abundance in their vicinity. It is rarely found away from roads or settlements. Although never a tall tree, it thrives well under cultivation, and sometimes attains a height of 60 feet or more.

The wood of the butternut is adapted for numerous and various uses. Its rich reddish-yellow colour, darkening with age, and then nearly resembling the English oak, as well as its lightness, render it suitable for cabinet work, for which it is also well adapted by the facility with which it receives paint or varnish, and the fact that it is not readily split by nails. For a like reason it may be advantageously employed for carriage-making and similar uses, being both light and durable. It is well fitted for purposes of interior decoration, and has been employed with excellent effect, both in the Cathedral at Fredericton and in other churches through the Province.

Of minor uses, the employment of the bark and nut-shells in dyeing may be mentioned, as well as that of the young half-grown nuts for the making of pickles. The bark is also said to yield an extract possessed of laxative properties.

Oak Family (*Cupuliferæ*).

The representatives of this family in the New Brunswick *Sylva* are (1.) The Red Oak (*Quercus rubra*, L.), the American Beech (*Fagus ferruginea*, Ait.), the Beaked Hazel-nut (*Corylus rostrata*, Ait.), the American Hornbeam (*Carpinus Americana*, Mich.), and the American Hop Hornbeam (*Ostrya Virginica*, Willd.), to which may be added, as introduced at a few points, the Spanish Chestnut (*Castanea vesca*, L.).

1. THE RED OAK (*Quercus rubra*, L.).

This, the only species of oak occurring in New Brunswick, is both common and widely distributed, being found in all parts of the Province, especially along the banks of streams, and, as in Charlotte Co., along ridges of slaty rocks. It is, however, a tree of inferior value, being difficult to season, imperfectly combustible, and, unlike other species of the same genus, worthless for the purposes of the tanner. It is, however, of rapid growth; flourishes well in almost all situations; and, owing to the beauty of its trunk and foliage, is well adapted for ornamental purposes.

To the above may be added the occasional occurrence of the white and grey oak in special localities. They are, however, so rare as to require no special mention.

2. AMERICAN BEECH (*Fagus ferruginea*, Ait.).

Three different kinds of Beech, viz., the Common Beech, the White Beech, and the Red Beech, are distinguished by lumberers and others. They are, however, probably all varieties of a single species—the White or American Beech, the differences depending, according to Emerson, simply upon the greater or less rapidity of maturation, and the consequent different proportion of the (white) sap wood or (red) heart wood. In one or other of its forms it is an abundant tree throughout the Province (except upon the Southern coast), abounding especially upon ridges of felspar rocks, and in rich moderately moist soils. It is a tree of rapid growth, increasing its diameter under favourable circumstances as much as two-thirds of an inch in a single year, and attaining sometimes a height of not less than 70 feet.

The beech is extensively employed for fuel, being indeed, for that purpose, second only to the rock maple. The wood is "hard, of a fine smooth close grain, and very dense, having a specific gravity of ·724" (Emerson). It is durable when kept dry, and also when permanently wet, as in the bottom of ships, but decays rapidly when subjected to alternations of these conditions. It is well adapted for the manufacture of saw-handles, shoe-lasts, plane-stocks, and for chairs and farm utensils. From its ashes large quantities of alkali are obtained for the manufacture of soap. Its nuts are oily and nutritious, and afford a large portion of the food of various wild animals, including the bear, partridge, and squirrel. Young beeches properly arranged, and by grafting made

to grow together, form solid and elegant hedges, but have the disadvantage of checking the growth of other plants near or under them.

3. THE SPANISH CHESTNUT (*Castanea vesca*, L.).

This tree, so highly prized in somewhat more southern latitudes alike as an ornament and for its abundant and agreeable fruit, can hardly be said in fairness to have a place among the indigenous trees of New Brunswick. None are found in a wild state; and though a few have been introduced from time to time, they do not appear to thrive, and are rarely seen.

4. THE HORNBEAM (*Carpinus Americana*, Michaux).

This tree, though by no means an abundant one, is occasionally seen in the New Brunswick woods, especially in the central and southern counties, along the banks of streams, and on the sides of ridges. It is found in considerable quantity in the vicinity of Salmon river in the county of Victoria, and in other places on the lands of the New Brunswick Land and Lumber Company. When conveniently attainable, it is used by lumbermen in the manufacture of axe-handles; and for other purposes requiring great strength, it is considered to be the strongest of the northern woods. When well seasoned it makes excellent fishing rods, being very strong, light, and elastic.

5. THE AMERICAN HOP HORNBEAM (*Ostrya Virginica*, Willd.).

This tree, readily distinguished from the preceding by the hop-like fruit from which its name is derived, is, like the latter, comparatively rare in New Brunswick, though apparently distributed over its entire area. It is generally found in rich woods, attaining a height of 20 to 30 feet. Like the preceding species, with which it shares the name of "Ironwood," it is remarkable for toughness and compactness, adapting it for the manufacture of levers and similar uses, whence it is also often called "Lever Wood." It is also employed for the cogs of mill-wheels and for agricultural implements.

The Birch Family (*Betulaceæ*).

This family embraces in New Brunswick five species of true Birch, and two of Alder.

1. AMERICAN WHITE BIRCH (*Betula alba*, var. *populifolia*, Spach.).

The White Birch, or Little Grey Birch as it is sometimes called, is a very common tree in New Brunswick, especially near the coast and on the poorer class of soils, such as occur over extensive tracts occupied by the rocks of the coal-measures. It is usually found in large groves associated with spruce, pine, or other soft-wood trees, and under favourable circumstances attains a height of 30 to 40 feet. The wood of the white birch is easily worked, and when well seasoned, light and strong; and is not liable to crack, split, or warp.

2. THE PAPER BIRCH (*Betula papyracea*, Ait.).

The Paper Birch, like the White Birch, which it nearly resembles, is found in all parts of New Brunswick, but usually in soils somewhat more fertile than those covered by its relative. It is said especially to favour gravelly soils and the slopes and bottoms of valleys covered with large and moss-grown rocks.

There are many thousands of acres on the head waters of the Miramichi, and on the heads of streams emptying into the Tobique in the same vicinity, which are covered with forests of this wood, where it grows to a large size, sometimes attaining a diameter of 2 feet and a height of 40. It is usually sound and free from rot. There is abundance of small trees growing here also, which are white hearted and suitable for the manufacture of spools or thread reels. One Maine factory turns out 100,000 gross of spools per day, and consumes 2500 cords of birch annually.

3. THE YELLOW BIRCH (*Betula excelsa*, Ait.).

This is one of the larger, and therefore, more valuable of the birches; its straight and nearly uniform trunk attaining at times a height of 70, and a diameter of 2 or more, feet. It is a very common tree in New Brunswick, growing usually on rich, soft, and moist lands in company with spruce and ash, and besides being extensively employed for many domestic uses, and for shipbuilding, forms with the black birch an important article of export. This tree is found abundantly on the lands of the New Brunswick Land and Lumber Company, both on the Miramichi and St John rivers.

It attains its greatest size on the fertile lands of the Upper

St John; it is a strong and durable wood. Besides its employment in shipbuilding, it has also been used in cabinet work, and in Fredericton for the frames of fanning mills and seed separators. When straight grained it is not liable to warp or split; it is susceptible of a high polish, and derives additional beauty from the peculiarly irregular and variegated disposition of the grain. The young saplings make excellent hoops.

4. CHERRY BIRCH, SWEET OR BLACK BIRCH (*Betula lenta*, L.).

This, the handsomest and the most valuable of the birches, is found in all parts of New Brunswick, flourishing in nearly the same situations as its relative, the yellow birch, and attaining about the same proportions. It is especially common on the deep and shady banks of rivers, and on gravelly ridges along the shores of the Bay of Fundy, as well as on the fertile lands on the Upper St John, east of the Grand Falls, and north of the Tobique river, where there are hundreds of thousands of acres covered by it, the land there being of excellent quality. This great body of birch extends over a large part of the Crown Lands in the county of Restigouche; the wood there is of large size and exceptional quality. It is also largely found on the Miramichi river and its branches; the soil there being inferior, the quality of the wood is not good. It also occurs in many other places on the Crown Lands of New Brunswick. The principal use of the black birch is for the manufacture of square timber for export and in shipbuilding, especially for the keel, lower timbers and planks of vessels; its most important characteristic being its durability when kept permanently wet. Being of a fine and close grain, readily capable of being polished, as well as possessing a rich colour, somewhat resembling mahogany, it is largely used for chair and cabinet work. It is employed by the carriage makers for panels. It takes any kind of stain well, and can be easily made to represent rare woods. The birch used in the Boston Navy Yard is kept under water, which not only prevents it from decaying, but much improves its quality.

THE WILLOW FAMILY (*Salicaceæ*).

The Poplars are the only trees in this family which require notice here.

The Balsam poplar (*P. balsamifera*), in its variety the Balm of

Gilead (var. *Candicans*), grows to a fair size along the shores of streams in the northern part of New Brunswick, especially on the banks of the Tobique, Grand, and Green rivers. Its wood may be used for door panels or other interior house finishing, as it is soft and easily worked; it takes a stain and finishes well. It is only locally abundant, and therefore of small importance commercially.

American Aspen (*P. tremuloides*, Michaux).

This tree is found in great abundance on the lands of the New Brunswick Land and Lumber Company, especially on the heads of the Clear Water, Wapskehegun and Gulquac, covering large tracts of land growing on ridges mixed with white birch and fir. It is of large size, attaining frequently a diameter of 2 feet. The larger trees are more frequently sound than the smaller, as the latter, when affected by disease or rot, soon die. It also occurs abundantly on the Crown Lands of New Brunswick at the head of the Miramichi, and along the Intercolonial railway, where, however, it is of smaller size. The wood of the Aspen, when seasoned, is tough, light, and hard. It does not warp, crack, or shrink, and is very close grained and white, and takes a high polish. It is used in the construction of sleighs and carriages, and makes excellent floor boards in house building, and might be used much more than it is for furniture and interior finishing. It also makes superior handles for hoes, rakes, or other similar implements.

III. *On the Plantations on the Estate of Sorn, in the County of Ayr, N.B.* By David Barclay, Forester.

The estate of Sorn, the property of James Somervell, Esq. of Sorn, is situated in the uplands of Ayrshire, about midway between the source and the mouth of the river Ayr, and about 15 miles from the sea as the crow flies. The area of the estate is computed at 6245 acres, and though its plantations may compare favourably with those of other properties in the district, they are not of very great extent, and may be set down at about 600 acres. Before entering on the present condition of the plantations, it may be as well to relate, as far as known by the writer, the history of the estate.

At an early period it was possessed by a Countess of Loudon. It is supposed that she planted the oldest and most remarkable trees. These comprise the English elms near the castle, some beeches that are planted in the form of a crescent in front of the castle, with the beech walk on the west, and the wood in the Cleuch on the east. It is said of her, when she read or heard of Dr Johnson's remarks on the treeless state of the Hebrides, or rather of Scotland, that she exclaimed, "Deil tak' the man! whar was his een when he didna see my Elms?" About the beginning of the present century, it came into the possession of the Somervells, merchants in Glasgow. At that time the greater part of the estate must have presented a very bleak and sterile appearance, but by the judicious and enterprising spirit of the late Miss Agnes Somervell, the area of the plantations was increased from about 100 to the present extent of about 600 acres. The original 100 acres are of the most permanent character, and are growing on the banks of the river Ayr, in the romantic Cleuch Glen, and extend along Sorn Bank to a little to the east of Dalgain. These are composed of the following species: alder, ash, beech, chestnut, elm, Italian poplar, lime, oak, plane, Scots and spruce firs. The larch that was formerly on the estate was all cut about twelve years ago, when the demand was good and the price high. The underwood consists chiefly of hazel, mountain ash, and briars, with numerous clumps of rhododendrons, which flourish here luxuriantly, and spring up freely from self-sown seed.

I will now detail the method adopted by Miss Somervell in forming the greater part of the plantations. The estate, for the

most part, was an extensive moor when she became owner of it—undrained, and without a tree for shelter; so that there was unlimited scope for improvements. She appears to have known, or been well advised, that the first step in estate improvement was, according to the old adage, "for agriculture to succeed, arboriculture must proceed." With wisely-directed skill she managed to overcome the difficulties which meet those who have to form plantations on poor peaty soils and bleak moorlands. Limestone existing on the property, she set about opening limeworks, and liberally dressed the land with the fresh lime; digging, trenching, and ploughing it in, and then cropped the land for two seasons before commencing to plant it. Open drains also were cut at certain distances apart to carry off all stagnant water, and the ground was thoroughly protected against the inroads of stock from the adjoining moor by a substantial stone dyke running along the boundary. The interior fences are composed mostly of beech, which have thriven well and form good hedges. After the liberal treatment of the soil above indicated, it was a matter of certainty that the plantations would succeed, in such a manner as to satisfy even the most sanguine expectations. The soil, for the most part, is peaty, in some places pure peat, resting on a clayey subsoil, well suited to grow a crop of Scots and spruce fir timber suitable for the local markets of a mining district.

The plan followed in laying out the plantations was most simple, the straight line being used, except around exposed farm homesteads, where the shelter-belts were laid out in curves, and around the top of Tinkholm Hill, where the line was carried about 30 feet below the summit, or about 900 feet above the level of the sea, and the highest point of the plantations.

It may be said that there is a sameness about the plantations, as the crop consists principally of Scots and spruce firs. This, however, shows the wisdom of the planter, because the soil is only adapted to grow such hardy kinds of trees, for which a ready market is now found in the neighbouring coalfields of upper Ayrshire; the extensive Airds Moss collieries being within a few miles of the estate. It is seldom that the planter reaps the benefit of his labours; but, if he takes a pleasure in the work of planting, it is a source of great satisfaction to see the trees thriving and the work proceeding in the manner desired. The lady who planted these woods does not appear to have had any desire to

reap a profit from them, and would not even allow them to be thinned, except in the slightest degree. Hence it was that an extra thick crop remained on the ground until it reached maturity; the very thickness of the crop bringing the trees the earlier to maturity, to the great advantage of the succeeding proprietor, to whom it afforded a rich harvest.

The success which followed the laying out of these plantations must be attributed to the advantages they had to start with; the soil was fresh and in first-rate condition, and the fences proof against the inroads of stock.

The hedges are a feature of the estate, and, along with the plantations, have added largely to the amenity and value of the property. They are formed chiefly of mixed beech and thorn, but are occasionally composed wholly of beech or of thorn, and there is one good hedge of hornbeam. They were laid out and planted by the same lady who formed the plantations, and although now past their best, they must have been splendid fences for many years, and great care was bestowed in keeping them properly dressed and in good order. In forming the hedges, the most of them have been planted too high on a raised bank, with a ditch alongside, and the consequence is, they suffer much from droughts. A raised bank, such as this, composed largely of light peaty soil, soon becomes void of nutriment for the hedge, with the result that the plants become stunted and perish, unless much money and labour is annually expended in manuring and digging the hedge-bottoms, to keep the plants alive and vigorous. It is always advisable not to plant hedges too high above the level of the ground, and to take care at all times to keep the soil well up to the neck of the plants when the hedge-bottoms are being cleaned and dug. In renovating beech hedges, it is best to proceed by cutting in one side of the hedge at a time, taking the stronger side first. Then in the course of a few years, when the first cut side has been fairly renewed, the other side should be treated in a similar manner, by cutting it close in, and filling up all gaps with healthy plants. The work of renovating and planting should be done early in the season, so that the roots may be in action to sustain the plants against the heat and droughts. The hedges while in a young state, and during the process of renovation, should be securely fenced and protected from stock and the ravages of hares and rabbits.

The late Graham Somervell, Esq. of Sorn, succeeded to the

estates in 1856, by which time all the operations already described had been completed, and some of the plantations were approaching maturity. These, in the course of the following years, were cut down, and realised a good profit, particularly the fine larch already referred to. Mr Somervell took great pains to replant the cleared woods, and during a period of about twenty years thus renewed upwards of 400 acres, which are now thriving well, although much difficulty was at times experienced in protecting them from the ravages of vermin while the plants were young. Between the years 1876 and 1881, an extent of over 140 acres was planted with 688,000 trees; which shows the keen interest the late proprietor took in his woods. Since 1881 the woods have been left very much to themselves, and are growing up again with much vigour, with the prospect of a good second crop, if they receive proper attention and judicious management.

A few years ago the trees in the Sorn Bank wood became unhealthy, and were cut down. Portions of it, being too wet for the growth of Scots fir, were planted with poplars, and the dry parts were filled up with Scots fir. All are doing well, and in the course of time, under good management, will give a full crop of timber. In some favourable spots in this wood are a few grand specimens of Scots fir; the finest on the estate is growing at Dalgain, above Sorn village, and measures 9 feet 8 inches in circumference of bole at 1 foot from the ground, and 8 feet 10 inches at 5 feet up. A part of the wood above Sorn Manse was cut down and replanted with Scots and spruce firs and larch. The firs are doing well, and the larch look healthy to the casual passer-by, but are badly affected with disease, to which probably many of them may yet succumb. Some of the plantations to the west of the castle and along the Mauchline road have been planted with hardwoods for a second crop, with spruce firs as nurses, which have been allowed to remain too long. The hardwoods have got drawn in consequence, with the result that the storms of last winter levelled the most of them.

The same storms played sad havoc among the remainder of the original plantations, extending to about 100 acres, growing along the sides of Tinkholm Hill at an altitude of between 800 and 900 feet. Upwards of 50,000 trees were blown over here by the gales, and their removal necessitates the cutting down of at least as many more, as the crop will average nearly 1000 trees

per acre. To realise a moderate price, these trees should all be cleared off within the next three or four years, before the timber begins to deteriorate.

The wood growing at the highest altitudes—say about 800 feet above sea-level—has during recent years brought £50 an acre thirty-five years after being planted, while the adjoining farm-land only brings 10s. per acre per annum; showing a yearly balance of 18s. 6d. per acre in favour of wood cultivation. At a lower altitude, woods forty-five years old were sold at £75 an acre, and the rent of the adjacent arable land was 15s. per acre, of which at least 2s. 6d. ought to be credited to the plantations for the shelter they afford. After all allowances are made for interest on the original outlay, these facts clearly prove that well-managed plantations pay the owner a handsome return within the reasonable period of a moderate lifetime, especially when they are laid out with skill on land of the nature of these uplands.

The woods which were replanted from fifteen to twenty years ago suffered considerably from the storms of last winter, but the blanks then made might be quickly and satisfactorily filled by planting poplars. In these woods the larch has completely failed, and has caused a thinness of the crop, but the Scots fir and spruce are thriving. The woods from ten to fifteen years old are now in a healthy condition, although they suffered much from rabbits when planted; there being as many as 100,000 young trees eaten in a year by these voracious vermin. The plantations have not been so much overrun with rabbits since the practice of letting them at so much per head was discontinued, which was simply putting a premium upon keeping up a large stock of the vermin. The remainder of the renewed plantations, from three to ten years of age, are very healthy, and promise in time to make a fine second crop.

The present proprietor does not intend to plant until he can do so with plants of his own raising; and with that object in view, he has recently laid out and partly stocked a home nursery. The site of the nursery in the Saugh Park was ploughed in the autumn of 1882, one foot deep, with four horses, turning up some of the subsoil. A crop of potatoes was planted in this in the spring of 1883, but the land was so infested with wire-worm that the crop produced little more than the seed. This year the beds for the forest tree-seeds were prepared without any manure, so that the soil is in rather a poor condition for the

plants to grow well. Rabbits abound in the vicinity, and as little is done to protect the plants from them, it is feared the labour will prove very much in vain. At present the management is in a state of transition. Formerly the wood was cut by the forester's staff, from 10 to 20 acres being cleared each year. Now the wood is sold standing to the wood merchant, who employs men to cut it at 3d. per tree, and ½d. per tree to burn the brushwood. The forester goes over the plantation with the merchant, and values each tree according to the class of wood it produces. The different classes are "propwood," from 6 inches at the thick end to 3 inches at the small end; "6-inch cuts" measure not less than 6 inches in diameter, and "7-inch cuts" not less than 7 inches, and so on. For these the following prices are obtained: propwood, 5s. 3d.; 6-inch cuts, 7s. 3d.; 7-inch cuts, 10s. per 100 feet lineal, and 3d. per cubic foot for larger Scots and spruce fir. The trees now being cut will measure on an average 30 cubic feet.

This is not likely to prove a satisfactory mode of operation, as the drains are filled up to allow the carts to pass through the woods. The upturned roots of the blown trees falling down on a part which is not burned along with the brushwood, will become a breeding ground for insects that will destroy the young plants whenever the ground is replanted, else there must be a long delay till the roots and brush are completely rotted. Young trees when planted near the old stumps, root all to one side, and consequently are easily blown over; and from the fact that they do not readily make roots among the old ones, they do not succeed so well as they should otherwise have done. In renewing plantations, it is of importance to use only the best variety of Scots fir, taking care to avoid the inferior sort, which is of a straggling coarse habit of growth, and does not stand the pinching of the side shoots so well as the native Scots fir. No doubt the poor quality of the soil is conducive to a straggling growth, yet a little pinching-in of the points of the lateral shoots, if done in time, does much towards a compact growth. When the lower branches of Scots fir are dead 6 or 7 feet up, they should be carefully cut off close to the stem. This affords ventilation, and gives room for more plants on the ground to select from at future thinnings. It also allows freedom for carrying on operations in the woods, and for beating out the ground game. Whenever woods get crowded and impenetrable by overgrowth or otherwise,

the rabbits increase with great rapidity, and quickly become a nuisance to all concerned; the farmer suffers heavily; the forester gets his work spoiled; the proprietor endures great loss and disappointment; and the gamekeeper is grumbled at by everybody.

I will conclude by briefly remarking that the woods on the estate were much damaged by the last winter's storms, and will take many years to recover, even under the care of a skilled forester. Many of the trees in the vicinity of the Castle are old, and past their best, and no storm comes and goes without laying prostrate some of the old favourites, or causing havoc among the heavier branches. Several gaps have been made in the beech walk, and the fine wood in the Cleuch is broken up in many places; so that the future of these fine woods and plantations is a subject for much careful thought and study by an experienced man.

I may add that Sorn Castle is of great antiquity, and is known to have been of considerable extent in 1409. It was added to in 1793, and was remodelled by the late proprietor in 1866. Till last winter, it was well sheltered from the prevalent westerly gales by woods on Sorn hill, which were much damaged by the storm that worked such ruin in the other plantations on the estate. Near the Castle stood the ancient village of Sorn; the modern village is half a mile higher up, on the banks of the river Ayr. The site of the old village mill is now occupied by the pretty modern flower-garden of the Castle. These changes and improvements have been the work of many years. The late Mr Graham Somervell took a great personal interest in the improvement of the estate and in the welfare of every one living upon it, ably filling the part of a wise, far-seeing, and kind country gentleman.

IV. *Natural Reproduction of Forests.* By JOHN M'LEAN, Forester, Edinburgh.

Natural Regeneration may be best defined as a branch of the science of Arboriculture, or rather let me term it Sylviculture, having for its object the reproduction of timber forests from seed, a subject which, I believe, has not received any great or special attention in the past history of British Forestry, at least so far as I am able to judge from my observations of woods in different parts of Scotland. From this, however, no one must jump to the conclusion that it is an operation quite unknown amongst us in the routine of practical forestry. In Scotland, at least, there are not a few extensive estates spread over portions of different counties, where natural reproduction is known and systematically practised with perfect success, especially among Scots fir woods in the northern counties, where local circumstances are found most favourable to carrying out such a system. When necessary, it is assisted, of course, by artificial means, with the most successful results. The future programme of forest economy must at all times be based on science and art, with a view to establish and facilitate a systematic code of rules by which the forester may be enabled to perform certain duties and operations with dexterity and skill. This will tend to produce the best results of practical forestry in its phases of profit, pleasure, and ornament, always leading on to having the right tree planted and growing in the right place. In order to carry this out to a profitable end, I will state the few points which must first be attended to.

All areas under woodlands should be clearly mapped out, so as to show distinctly the boundaries and divisions of the various blocks ; connected with this map there should be a forest book containing details of the names of the woods and the numbers of the blocks ; their age ; length of period of rotation ; description of soils and subsoils, and their suitability to grow and mature certain species of trees under local conditions ; also noting the annual rate of growth of certain species, and all experiments carried out each season. This would form a basis upon which all operations might be grounded, and it could be deviated from when circumstances rendered it necessary to do so. The loss to the owners of private woods is much greater than is generally imagined, owing to the common want of a systematic basis in

conducting the routine forest work, and especially is this the case where those in charge of the woods are often changed. The most essential work for the time being of the skilled forester is perhaps utterly neglected, which entails a heavy loss to the proprietor at a future period, although it cannot easily be detected at the time by the uninitiated. Or, it may be the persistent and careful experiments of the enthusiast that is thus neglected and thrown aside as worthless, before the fallacy or the practical soundness of the problem aimed at can be solved, and thus cause a serious loss of valuable knowledge to the profession. It is by the practical experiments carried out by enthusiasts that the medical profession has attained to such a high standard in the preservation of health and prevention of disease. And so it is with the forester, who, without the practical aid of experiments in many cases, may be compared to a captain without a chart sailing in strange seas. His being right or wrong is a mere chance, and he may be treating his subject the reverse of what Nature ordains, with results the most unsatisfactory. Let me quote the words of Professor Huxley. He says that "ignorance is visited as keen as wilful disobedience; incapacity meets with the same punishment as crime. Nature's discipline is not even a word and a blow, but the blow comes first without the word. It is left for us to find out why."

The woods and forests of this country may be designated as of two kinds: first, underwood or coppice, *i.e.*, wood which is grown and cut at short periods of from 20 to 30 years, composed of deciduous trees, and which are reproduced by suckers from stools. The second may be called timber forests, *i.e.*, wood which is only intended to be cut at intervals of long periods, which may be reproduced naturally or artificially, and may be composed of evergreen or deciduous trees—conifers or hardwoods—which are grown for the purpose of yielding the heavy timber used in the various branches of manufactures and art.

I shall confine my remarks at present to the second or timber forests. Various species of timber trees have different constitutional habits, and it will be necessary to set forth a few examples by way of illustration. We will first assume that a Scots fir wood is about ready to undergo a process of restoration, and that the process is intended to be brought about, if possible, by natural reproduction from seed. By this it may be taken for granted that the said forest or wood is ripe, or approaching maturity, from

an economic point of view. This may occur at any age ranging from 80 to 120 years. But it will depend much upon local circumstances, as the ratio of growth and the vigour of the trees will be in proportion to the conditions of the climate, soil, elevation, aspect, and exposure.

It is presumed that the forest is fairly drained and securely fenced. The first operation, then, is to begin a series of thinnings at intervals over the entire forest, adopting at the outset a systematic method of selection of reserves at each felling of timber. These thinnings should extend over a considerable period of years. I would urge that in all cases the first cutting be carried out with great caution; and this should be specially attended to when the crop upon the ground is dense, as all the roots will be weak and superficial in proportion to the density. The trees, therefore, cannot have such a hold in the soil, and will be liable to suffer injury from boisterous winds. To guard against this, a thick sheltering belt ought to be left all round the outside of the forest. By so doing it will serve a two-fold purpose of some importance. First, to act as a barrier against the wind; and second, to give shelter to the young seedlings. Should the forest be so extensive that it is impossible to spread the periodical thinnings over the entire area, it will be necessary to adopt another method, viz., to have it done in sections or sub-sections as may be found most suitable. In commencing to fell the timber within the belt that is left for shelter, begin at the side which is most exposed to the breeze. By so doing the older seedlings will help to shelter the younger from the blast. At each thinning it is essential to select the worst trees for cutting first, such as those that are stunted in growth and deformed; all that show any signs of decay, as resin bursts, foliage changing to a yellowish green, annual growths arrested or diminishing, and those which bear great numbers of cones of a diminutive size; these being all indications of approaching decay. At each felling, all the loppings of branches and brushwood should be gathered into heaps and carted outside the wood, without delay, to any open spot where they can be burned, so as not to injure the foliage of the reserve trees, or any seed that may be germinating near the surface of the ground. Should the surface of the soil be covered with a tough herbage of grass or heath, it will be necessary to go over it, after the brushwood and rubbish is removed, and take off large sods, say 18 to 24 inches in

diameter, at regular distances apart, and then loosen the soil with a tramp or shoulder pick, so that the seed may alight on the prepared portions of the soil as they drop from the trees or are blown down by the wind. This operation should be performed after all the cuttings. When the last cutting but one is to be made, which may vary as to time according to local circumstances and in proportion to the progress of regeneration, there ought to be a good sprinkling of seedlings interspersed here and there in groups all over the ground. At this thinning, standards must be selected at regular intervals as reserve trees, so as to ensure a more complete dispersion of seeds from the cones. The trees left as reserves should be in good health, with clean tall boles, and flat expanded heads, equally balanced all round, so as to distribute the seed as evenly as possible, and allow air and headroom for the young trees. In carrying out this operation much must be left to the discretion of the forester as to the different methods which may have to be applied according to circumstances. It would be tedious to enumerate all the details of the different plans involved in carrying out natural reproduction, indeed, I do not shrink to maintain that it is impossible to do so, as the method of application which may prove quite a success in one place may be a complete failure in another, even within a radius of a few miles. This may occur from various causes, such as the nature of the soil, subsoil, altitude, exposure, and such like. All such operations must invariably be conducted and guided according to natural and local conditions. There is a proverb which says, "the errors of a day may take years to rectify,"—a truism reminding us that we should cherish prudence and circumspection in all our undertakings.

When the final cutting of standards has to be performed, it will be judicious to begin the felling of the reserve trees from the reverse point of the previous fellings; performing all the other operations, such as loosening the soil, etc., as already described. If the prevailing wind is from the west, the final operation of felling will proceed from the east side. By this the action of the wind will go far in assisting the dissemination of the seed into the prepared soil. Great care must be taken in felling the timber among the younger crop of trees, as their heads at this stage will be furnished with a heavy canopy of foliage in proportion to the size of their stems. Consequently it will be necessary in most instances to lop all branches off the reserve trees before

they are felled, and at the same time a rope should be attached to the top of the trees, in order to guide them in their descent to where they may fall with least injury to the young plants. The foregoing details may be deemed sufficient for carrying out the practical operations of natural reproduction from seed, and may also be considered as applicable to both hard and soft wooded trees.

Before we pass from this subject let us turn our thoughts to a few remarks upon the seed of Scots fir, and briefly to the demerits of inferior seed; a matter which must always possess a considerable amount of importance in connection with the process of natural regeneration of forests if success is to be attained. The seed of the Scots fir is of a light nature, consequently it is wafted by the wind to great distances; its winged appendages forming an important factor in the process. The constitution of this tree is extremely hardy, and it may therefore be considered invaluable from many points, viz., it is able to endure great extremes of cold and heat, factors which are of no little importance in their bearing upon the germination of the seed, and also the healthy development of the young trees. But while these remarks can be justly applied in advocating the merits of Scots fir seed, the line of demarcation must be drawn here, as they do not apply to the seeds of conifers in general. And with this I venture to offer my ideas, however imperfect they may be, that to carry out the natural reproduction of woods from seed by natural sowing, the vital point is to obtain strong healthy seed, with an equal distribution of it over the ground, from vigorous reserve trees during the whole period of regeneration. It may be asked how can such an operation be conducted upon the lines described, where only half a crop exists, and that often in a weakly condition in some portions of matured woods? But I am well aware of this unfortunate fact which undoubtedly prevails, to a great extent, in the woods of this country, sometimes arising from a haphazard system of management, and at other times from natural causes which might have easily been foreseen. Light and air being essential to the growth of the young plants, it is necessary, in order to guard against the sunlight being confined to patches, that the standards should be equally distributed over the entire area, so that the sun's rays may not be too strong in one spot and too weak in another. Let us try to illustrate this point by an example. For instance, should the soil be of a sandy or calcareous

nature, the result will be as follows:—in a dry season young seedlings will be apt to get scorched under the influence of too much sunlight, while, on the other hand, in wet seasons in strong tenacious soils, and under the influence of too much shade, cones and seeds of all trees are liable to rot, and plants germinating under such unfavourable conditions sicken and die from want of the necessary amount of sun-heat; from which it is obvious that extremes in all cases are decidedly injurious.

A word in regard to the selection and choice of seed. It is remarkable how little care at times is bestowed upon the selection of seed. It seems in reality to be only stating a truism that the labour of cultivation is utterly lost if bad seed is used. A diseased or weak parent tree cannot produce strong progeny; neither can an inferior seed produce a perfect tree. There is therefore the greater need to take every precaution, to insure that the produce of healthy trees only is allowed to ripen and disperse over the forest to raise a crop of trees; and hence the necessity for removing all sickly or deformed trees at the earliest possible date, to prevent them bearing cones, the seed from which is always inferior. Cones borne on vigorous and shapely trees, are certain to contain seed which will produce a healthy and vigorous progeny.

Let us turn now to the natural reproduction of the Larch; and allow me to impress upon all the necessity of displaying even greater caution in conducting the operations in connection with larch, than has been shown to be necessary in regard to Scots firs. During the process of renovation, all the thinnings should be conducted upon a limited scale, never omitting to leave an equal distribution of reserve canopy in every part of the wood. I am inclined to believe that larch, between the ages of one and eight years, is rather a delicate plant, and although it requires a certain amount of sunlight, which is essential to its health, yet, between the ages indicated, too much sunlight is as injurious to it as too little. In youth it comes early into leaf, and the growth is apt to be further advanced in the leading shoots than in the laterals; hence the former is more subject to injury from spring frost. Any one can satisfy himself of this fact by examining the seed-beds and young plants in a nursery after a frosty night in early spring, when the leading shoots will be found checked in their growth, and unable to keep pace with the laterals, which, owing to their backward state of growth, have escaped injury. Some

authors maintain that the larch is stimulated into action by a mild temperature early in the season, and that its annual growth commences at once. From my observations of the nature and growth of the larch, I am inclined to differ from this opinion. The process of growth in larch is slow and is generally retarded until after midsummer, about the end of June or beginning of July, when the active powers of growth become vigorous. In contrast to this, take as an example the Scots fir, or any other pine. Their growth is almost completed before larch begins to grow, and the latter continues to grow in mild seasons until late in the autumn, which is in no way favourable to its constitution, as it is liable to be injured by frost before the young wood is properly ripened.

In regard to the Spruce, its hardihood, rapidity of growth, and suitability to almost any kind of soil, have never been seriously questioned, but it can only be seen in its pristine grandeur when growing in a free, moist soil. Spruce fir is specially adapted for growing in low, moist situations. It has no tap roots, as a rule, like the Scots fir and other pines. Its roots do not penetrate deep into the soil, but spread near the surface. Its foliage is rather dense, which renders it top heavy, and in exposed situations it cannot resist the force of strong gales so well as most other forest trees. Soils of a moist nature encourage the growth of a tough coating of herbage, which is not only unfavourable to the germination of spruce fir seed, but to that of all pines. Then at intervals most species of trees are liable to be unproductive, or their seeds unfertile in some seasons, and in the case of spruce woods it has not yet been found a profitable matter to renovate them by natural reproduction in this country. Still, it can be carried out by the same means as larch and Scots fir.

We shall now pass from the pine family with this remark, that with all the numerous introductions of conifers and other trees into Britain, we must not overlook those which have proved themselves so hardy in the past, as to resist the effects of the winter blasts of our climate in exposed situations. We must therefore look carefully after them, so as to ensure them from becoming extinct, as they are naturally the trees best adapted for planting upon the hills and bare wastes which cover so much of the surface of this country, and which are vastly improved by a clothing of our hardy forest trees.

I shall next endeavour to apply the natural mode of reproduc-

tion to deciduous forests, containing a mixed crop of hardwood trees. In order to do so, it will be necessary to mention briefly a few of the deciduous trees which compose the woods of our country, viz., the Oak, Ash, Beech, Elm, Maple or Sycamore, Spanish Chestnut, Cherry, Birch, Alder, Horse-Chestnut, Hornbeam and Hazel. With this number of species of a good age, which a mixed wood is assumed to contain, we may begin the work of reproduction without delay, by frequent thinnings at stated periods, as already detailed. The first point which engrosses our attention in connection with the operation is, How can we best accomplish our object in order to obtain the best results? Here also it will be necessary to consider which kind of tree is the most likely to attain the greatest value in a given time, and such trees must necessarily have precedence as the future crop. At the same time note must be made of the kind from which the supply of timber has to be furnished for estate and local demands. Due attention must also be given to the following, viz., the probable financial results to be obtained from the produce of the crop by judicious management; the means whereby the timber may be most expeditiously brought to the market, which latter includes a sufficiency of good roads throughout the woods. These and many other points which it is unnecessary to relate, cannot, or ought not, to be lost sight of by the practical forester when conducting operations with a view to either natural or artificial reproduction of forests.

We next proceed to examine the ground, in order to ascertain whether or not drainage is required, care being taken not to overdrain the ground, as the trees will thrive better in a moderately moist than in a very dry soil. All the drainage that is requisite is to remove the water likely to accumulate in miry or quaggy parts of the wood. The surface vegetation will indicate to the practical eye if the soil is in want of further drainage. It now remains for us to carry out the operation of thinning by a selective mode of treatment, as already described for Scots fir; removing the birch and Spanish chestnut, and, if possible, felling all the inferior trees first; reserving those of a sound and vigorous growth until it becomes necessary to remove them in rotation out of the way of the young trees. It will be judicious to conduct all the thinnings by successive selections of the most suitable trees, until a sufficient distribution of seedling plants are spread over the entire area to ensure a crop. As many seeds of forest

trees do not germinate until the second year after being committed to the soil, the various thinnings ought to be regulated according to the growth and progress of the young seedlings, until all the timber is felled, except the reserved standards or seed-bearing trees. These should be left for some time in order to complete the final sowing of seed, and also to assist in preventing the surface of the soil from drying up, as well as retaining a canopy for shelter against cold winds and unseasonable frosts.

In connection with this, I shall point out some of the advantages to be derived in carrying out natural reproduction with a selection of species over the same operation in a wood consisting only of one species of tree. We will take a wood of any two species of mature hardwood trees; as, for example, the oak and the beech, which are in many respects allied to one another. In considering regeneration in their case, at the outset we are beset with natural obstacles; for no reliance can be placed in obtaining an annual crop of seed from those trees. One season there may be a good crop of acorns, while there is a dearth of beech mast. The following season there may be abundance of the latter, and none of the former; in fact, it is a rare chance to obtain a crop of seeds of both oak and beech in the same season. This drawback, coupled with an uncertain climate and an inferior soil or subsoil, will greatly retard the process of regeneration. Consequently, with such obstacles, it will take longer time to complete the operation, and in certain cases it may end in failure. On the other hand, where a wood is composed of a varied selection of trees, reproduction can be produced in much less time; for we can almost rely upon obtaining seed from some of the varieties annually if the seasons are in any degree moderate; therefore, under such conditions the work can be safer and sooner performed than by the former example.

I shall next draw attention to another method for the reproduction of hardwoods by means of sowing the seed artificially. In order to render the process clear, there are several things which must be defined to some extent. I shall therefore class the seeds of hardwoods into three divisions—first, those seeds that require to be sown immediately after arriving at maturity, such as alder, birch, and elm; second, those which do not generally germinate until the second spring after ripening, such as the ash, cherry, hornbeam, and service; third, those which fall into the category of heavy seeds, which cannot be dispersed to

any great distance by the action of the wind, such as oak, beech, chestnuts, and hazel, and to these we may add the maples. The latter class all germinate the following spring after they are ripe; the second class must be gathered and pitted for some time; the first class may be sown immediately after the seeds are ripe. Heavy seeds may be gathered as soon as they are ripe, and planted in vacant portions of the woods by dibbling them into the soil to the depth of two inches. The seeds of maples and suchlike do not require to be placed so deep; about an inch is sufficiently deep for them, and they may be sown as soon as they are ripe.

A great deal more time ought to be devoted to this work of renovating woods than is usually given to it. If a few women or boys were employed during the autumn to gather the seeds of hardwood trees as they ripen and fall, a great advantage would be derived, and wonderful progress might be made in reproduction at comparatively little cost. The women and boys should be under the supervision of a skilled man, who would take care to select the seed from healthy trees, and to see that it was properly planted in the vacant spaces in the woods. All healthy seed-bearing trees ought to be specially numbered previous to the seeds being gathered. It would be judicious to have this done in the summer when the trees are clothed with their foliage, and any signs of decay are more easily detected than when the trees are in a leafless state.

Seeds of pines and other trees might also be sown with great advantage on rocky ledges and elevated spots difficult of access, where it is almost impossible to find enough of soil to plant the roots of a tree in with any prospect of success. Seedlings in such exposed places have a better chance to grow up, inured to the blast and firmly rooted in the crevices of the rock, so as to be able to brave the fiercest storm.

Then as to fencing in connection with the natural reproduction of forests, permit me to say it is an absolute necessity to have all woods undergoing the process of regeneration fenced in a substantial and secure manner, so as to perfectly exclude hares and rabbits and all such destructive vermin. If young seedlings are eaten over before they have developed buds or leaves, they perish immediately. The leaves and buds are essential to the life and growth of a plant, and if these be nibbled off the seedlings, it is in vain to expect a healthy and vigorous crop of trees from any

process of regeneration. It is therefore utterly impossible to carry out the reproduction of woods with creditable success where vermin are allowed to accumulate in large numbers, without taking the necessary precaution to enclose the area with adequate fencing. The destruction of young forest trees by ground game and vermin entails a serious loss to the proprietor, and is a source of great trouble and disappointment to all concerned; therefore every means should be taken to exclude them from young woods from the very beginning.

Let me now draw attention to several errors in the management of woods which at times are apt to be overlooked, although of great importance. If woods are allowed to become too open from any cause—say overthinning—they become defective from want of shade, and the moisture accumulated during the winter is dried up in the early summer before the growing season is over. We must not forget that water is a very important element to vegetation. Trees will live in almost any soil,—though they may not attain to any great value,—so long as it is moist enough and of sufficient depth to retain moisture. In order, therefore, to economise the moisture of winter, so that it may last through the period of active growth in summer, it is necessary to have the ground in the plantations sufficiently shaded from the action of the sun's rays, more especially in dry situations. It is quite common to see trees in woods of a branchy, straggling habit of growth, while the ground between them is covered with a thick coating of grass and weeds, usually indicating that the woods have been overthinned, or have been mismanaged or neglected in some way. Nothing betrays this more plainly than to see trees developing vigorous laterals, which are a sure sign of the presence of too much sunlight, and shows that the canopy of foliage is not dense enough. This applies more especially to evergreen trees of the pine family, the larch excepted, which delights in sunshine.

Again, we often meet with hardwoods growing in places where pines only should be planted; and on sites suitable for hardwoods we too often find a crop of miserable pines, showing that the planter was ignorant of the nature and habits of the trees he was dealing with. Hardwoods are in no way suitable for planting upon exposed sites, nor at high altitudes, and can only be grown to advantage in moderately low-sheltered situations. Conifers, however, are peculiarly well adapted for growing at high elevations and in exposed situations.

I have already described a variety of soil where certain hardwoods can be grown collectively. I shall now state briefly where those can be best grown individually. The ash may be seen growing best on a loamy soil, with a porous subsoil, in moist situations near to streams. It is in no way suitable for being grown upon tenacious clayey soils, and should not be planted in them. Young seedlings of ash are very liable to be nipped by spring frost.

The beech is a tree which is not fastidious as to the soil in which it grows. It is seen growing in all soils, from heavy clayey loam to light sandy soil, in the latter of which it is seen at its best, if it be not too barren or too dry. Its habit is umbrageous, and, like the spruce fir, its roots run near the surface, which makes it a valuable companion to the oak, whose roots dip deep into the soil. The beech is also able to stand a great amount of shade, and, along with the silver fir, we have no trees to equal them as underwood for growing in the drip of other trees. The seedlings of the beech are also very sensitive to frost, especially until they have developed their true leaves.

The Scots elm also must be regarded as a hardy and accommodating tree. Although it delights to grow in rich moist soils, still it is often found growing upon the most barren soils and in the most exposed situations. From observations of its growth and quality, I venture to say that it ought not to be planted in dry, sandy, or calcareous soils, as in such it is very liable to dry rot. Trees may be affected with rot, and, so far as outward appearance goes, they may show no sign of disease, beyond the stems being slighty enlarged from the base upwards for a few feet.

The oak may be seen growing to the highest perfection in a strong loamy soil, with a deep subsoil of an open clayey nature, but it should always be grown in the best soils, so as to produce the finest quality of its valuable timber.

The hornbeam luxuriates in a similar soil to the oak. This is the tree which Evelyn adored as the foremost of all deciduous trees. From what I have seen of its merits, I am of the opinion that more of it should be grown in Scotland, as its timber is of first-rate quality, and is in much demand for the manufacture of articles of turnery.

The sycamore is another tree of great value in the reproduction of forests, as it produces good seed at a comparatively early age. The soil best suited to its growth is a moist loam. It is valuable for planting in exposed situations, either maritime or inland, as

it is able to withstand the sea breezes better than any other deciduous tree, and its hardihood enables it to grow to maturity upon hot barren soils where other hardwood trees would languish and die. Its seeds will germinate in the poorest soils, and I have frequently observed them springing up freely in woods which were under the influence of the sea breeze, even in exposed places where other vegetation seemed nearly extinct.

Both the Spanish chestnut and the horse-chestnut are good trees for reproducing forests, as they seed freely at an early age. They prefer to grow in a deep sandy loam. The horse-chestnut is better adapted for ornament than for purposes of profit. Its brilliant spikes of flowers, of various hues, present an attractive feature in the park or forest in early summer.

The alder is a tree which grows rapidly in cold and wet soils unsuited to most other trees, while it produces useful timber and seeds freely at an early age.

I have simply attempted to describe a few of the primary details and features connected with the operation of the reproduction of woods. But were it necessary to conduct by artificial means the afforesting of extensive tracts of moorland or rough waste lands, the operations here described would be both tedious and expensive. In that case recourse must be had to other means to diminish expense and economise time, by introducing other implements than the spade, such as ploughs and grubbers, with horses, oxen, or steam as the motive power.

In concluding this paper the writer may state that he has endeavoured to select and lay before his readers suitable illustrations in connection with this important subject as far as his limited experience and ability permitted. But the incidents and features are so numerous and different, that volumes instead of pages might be filled without exhausting the subject. Let it be understood that the writer has by no means given his suggestions and observations with the intention of teaching others, but simply in order that thereby an interchange of thoughts and observations may be promoted. There is no department of natural science which affords such an abundance of pleasing investigation as that contained in the vegetable kingdom. It invites the attention of every intelligent mind, with a feast of gratified reward for diligent research.

V. *Pruning: Its Ornament and Utility.* By Alex. T. Gillanders, Forester, Skibo Castle, Dornoch.

Mankind have always been lovers of trees. Whether we read ancient or modern history, we find the same fondness of trees. Indeed, they have often been planted to perpetuate the memory of heroic actions. Poets, painters, and philosophers have all admired trees and drawn inspiration from them in their respective studies. A tree has always been considered a fit object to arouse the æsthetic sentiments of a musing or thinking intellect. If trees, then, have such lofty ideas in connection with them, the wonder is that arboriculture has not yet found a place among the sciences, or that the forester has been hitherto looked upon as little better than a mere hewer of wood.

Having said there is so much beauty in trees, the question arises, what does such beauty consist of? Various reasons have been adduced as to the metaphysical origin of beauty. According to some, beauty consists of order with design, unity with variety, or in their relations. The æsthetic sentiment is aroused when we see well-arranged forms and proportions; and likewise in the recurrence of rectilinear figures, such as the square or parallelogram. Beauty, too, is seen in the symmetry of likeness, side by side, and in the repetition of similar parts. In trees beauty may be seen by the most cursory observer in a series of regular lines, in the approximation of definite angles, and likewise in the union of the firm with the flexible. How beautiful to see the stem and branches gradually tapering into slender points, and to behold the slender parts yielding to the gentle breeze while the stout stem stands firm.

But while we thus trace the geometrical forms which give rise to the sense of beauty, we must never forget that no feeling of beauty is aroused unless the regularity is seen to be something apart from mere mechanical arrangement—a regularity which is in accordance with nature. Hence, in giving a definition of pruning, both for the purposes of ornament and utility, we may say that it is the art of aiding, not of improving nature—the art of cutting off useless additions and imperfections—additions which are considered ugly and worse than useless. Therefore the pruner, instead of trying to show his art and handiwork to the eye of the passer-by, ought to try and make Nature hide Art.

It has always been a principle of mankind to work first, however rude and imperfect, and then discover the principles upon which the work is based; and so it is in pruning trees. Many foresters may be able to prune trees, both for the purposes of use and ornament, and yet be unable to define any principles upon which the art of pruning is based. Presuming, therefore, that while the majority of foresters are practically able to prune trees, I may be allowed to lay down what I consider a few guiding principles. In other words: how are we to prune trees in harmony with their habits so as to increase their beauty and value?

To many persons the idea of a tree is nothing else than a large plant, with an ascending axis or stem from which spring an indefinite number of branches ramifying in all directions; the former being suitable for timber, the latter fit only for fuel. To persons of no higher ideas or tastes the pruning of a tree ought not to be intrusted.

The direct object of pruning is either for use or ornament, or it may be to prevent trees from being blown down by the wind.

If pruning for ornament is the object in view, it may be sometimes allowable to sacrifice intrinsic value to a certain extent, especially within policies or along roadsides. On the other hand, when pruning for utility is the object, ornament should not be altogether sacrificed, and need not be except within plantations. In order to carry out ornamental pruning properly, remember that it is necessary to study the natural habit of trees.

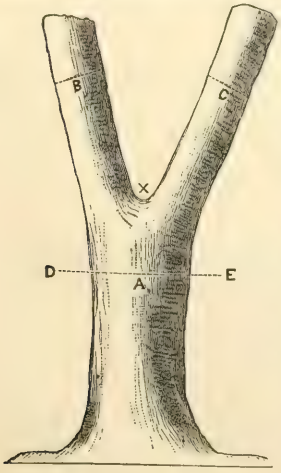


Fig. 1.

Many debates have arisen as to whether pruning increases the size of a tree or not. One thing, however, is certain, that early and judicious pruning increases the commercial value of timber trees. Fig. 1 will illustrate this. Had pruning been resorted to when the tree was in a young state, we should have had the trunk A prolonged instead of forking at X. Now, suppose the trunk A is 10 feet long, and that we cross-cut B and C at 10 feet in length

respectively, and sell the three pieces. The part A yields more cubic measurement, and consequently brings a larger sum than the other two pieces. If the trunk A had been prolonged in thickness with the natural taper to the length of 20 ft., the tree would have been of much greater value, which is easily demonstrated as follows:—Suppose the two parts B and C were welded together they would not be so thick as A. Fig. 2 will illustrate this geometrically. Circle 1 represents a section made through D, E (Fig. 1). Circle 3 represents sections made through B and C (Fig. 1), and according to a well-known geometrical problem, circle 2 is equal in area to twice the circle 3, representing B and C, which are of the same size. Hence may be seen at a glance the great loss incurred by allowing the tree stem to fork. Many writers maintain that pruning has the immediate effect of increasing the size of a tree, and that periodical pruning ought to be adopted to increase the value of a tree. Early pruning or training increases the size and value of a tree ; but it is equally true severe and repeated prunings decrease the size and consequent value.

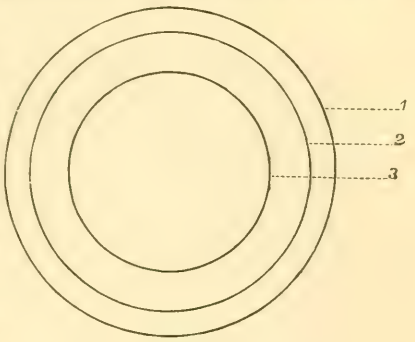


Fig. 2.

The simplest method of pruning is the process of disbudding. Coniferous trees very often require to be treated by this method. When a coniferous tree loses its leader the top whorl of branches turns upwards, and by disbudding all but one of these shoots we can form a leader. At other times when a tree shows two contending leaders, the pinching of the terminal buds of one of the rival shoots will cause the tree to grow with a clean stem instead of a neglected and forked bole like Fig. 1.

Following the dictates of experience we find that pruning is most beneficial when young trees are operated on. Forest trees in a neglected condition and of a comparatively young age, often come under the forester's treatment, and such trees if judiciously pruned will be enhanced in beauty and increased in value.

When the ordinary pruning knife is found too weak for the work, the pruner ought to be furnished with proper tools, such

as a hand-saw, pruning chisel, and averruncator. When pruning has to be performed to any extent by a number of workmen, it will be found indispensable to have a skilled person to superintend the operations, and if the superintendent has his heart in the work, he will find his time fully occupied. Assuming, therefore, that we are in the position of such a person, how should we proceed with the work?

In the first place, we should survey the outline of the tree under treatment, and mentally calculate the amount of pruning required. A very little observation will show that the outline of all trees is either an isosceles triangle, a circle, or an ellipse. Having formed in our mind's eye the shape of the finished tree, we at once commence operations. Comparatively young trees, especially oak, growing in a freely exposed place, produce on their stems and leading branches a great number of small spray, fit for nothing but to suck the sap from the main body of the tree. All these ought to be cut off. In addition to these twigs, we find a number of branches radiating from the stem, without getting their extremities to the outside owing to the crowding of the stronger branches. These ought to be cut off from the stem or at other parts which will not spoil the shape of the tree. Having done this, nothing further remains but to prune the tree, according to its natural form, by foreshortening the branches more or less as may be found necessary. Attention must be paid to the outline so that the tree may be properly balanced. Strong branches ought to be cut close in at the most appropriate fork, so that the part left may grow in the direction of the part cut off. Branches rubbing against each other ought to be separated. A strong branch bending upwards among horizontal branches ought to be cut at the commencement of the curve. In addition to strong side branches, all upright shoots ascending from horizontal branches towards the top of the tree ought to be cut clean off. Some writers maintain that the operation of pruning ought to commence at the top of a tree. As a general rule, the operation will be found more easy to work from the base to the apex. Pruning from base to apex has many advantages, and ought to be generally insisted on. Branches cut off at the bottom fall easily to the ground, whereas branches cut at the top fall on the long lower ones, and, collecting, have a tendency to break them. All dead or decaying branches ought to be cut clean out from base to apex.

In the process of foreshortening, care must be taken to do the work in accordance with the laws of nature. Thus, due notice ought to be taken of the angle which the branch makes with the stem, and likewise the curve which the branch takes. Some pruners believe in cutting out the terminal shoot of young branches. But nature will have her own way, the lateral branch growing in the same plane, and uniting with the stronger part, forms the same original curve. Others lay it down as a maxim that all branches ought to be trained by a pruning process to a horizontal shape. To do this universally is trying to change Nature. Suppose, for example, we are pruning a Lombardy poplar, would it not be absurd to attempt forming horizontal branches?

In order to prune or lighten trees as a prevention to their being blown over by gales, we ought not to mar their beauty. Due regard ought to be taken to balancing them by taking off strong side and top branches, or those within the centre which may produce the effect aimed at, without marring the beauty of the tree. Unless guided by the principle of "better losing part than the whole," we ought not to spoil Nature.

Some maintain that pruning is always injurious to trees, and that while it is essential to the increase of marketable timber, it ought to be done cautiously and by degrees, believing that to cut "close in" to the stem injures the tree. Such practitioners either make their cuts about a foot from the stem, or they peel a ring of bark where the branch is finally intended to be cut. Each of these methods is equally bad. Instead of saving the tree, a little observation will show that they are injurious; whereas close cutting is beneficial. When a branch is cut off at a part where no other branch remains, either young twigs spring up or the stump dies back to the bole of the tree. And if the dead stump is cut off at the expiration of a year, or at the earliest period procrastination will permit, the cut never heals. Thus, the decayed part absorbs moisture, and imparts disease to the tree. On the other hand, if a branch is cut "close in" at the proper season, healing commences soon after, and quickly and effectually completes itself.

In order to facilitate healing, all wounds ought to be made perfectly smooth and even. If this be not attended to, protuberances will be formed on the stem. As a general rule branches swell a little at their union with the trunk, but it is preferable at times to cut a portion of the bulge so that the trunk

may have an even surface, without twigs springing from the wound.

All wounds which will not heal in a single season ought to be covered with coal-tar containing a small quantity of paraffin. This mixture is preferable to paint. Wounds which have not been covered absorb moisture, and impart decay to the tree ; and although the mark of the cut may be no longer seen from the outside, a decayed piece of wood presents itself when the tree is sawn up. On the other hand, if the wound is covered with coal-tar only a small streak is seen when the timber is cut up after the wound is healed over.

Great diversity of opinion has existed in regard to the proper season for pruning. The season in which pruning is performed has a deal to do with the healing. Wounds made during the winter do not heal so much during the ensuing summer as cuts made in the earlier part of summer. Winter pruning gives rise to a greater abundance of young shoots than summer pruning. In fact, pruning may be performed at any season except during late spring. At that season the ascent of the sap is in full play, and wounds made then bleed so much that they never heal satisfactorily.

VI. *On the New and Rare Coniferæ at Penrhyn Castle, North Wales.* With Illustrations. By Angus D. Webster, Forester, Penrhyn Castle, Bangor, North Wales.

Bounded on one side by the Menai Straits, and on the other by the great Snowdonian range of mountains, this estate affords peculiar advantages for the successful cultivation of the less hardy conifers of recent introduction.

The mild, genial climate of this part is clearly shown by the growth of such plants as *Hydrangea hortensis*, *Fuchsia Riccartoni*, and *Cunninghamia sinensis*—all of which stand our winters with impunity. Being at a considerable elevation above sea-level, those parts of the park around the castle are often exposed to cold, cutting winds, blowing in from the Irish Sea, or to still more severe storms from the south-west, which latter often occasion much damage to trees and shrubs. From a list preserved here it would appear that at one time (upwards of thirty years ago) most of the Conifers then introduced were planted out experimentally over the park. Of these many have died out altogether, others have progressed very slowly, and many additions have been made of the kinds which seemed to thrive best in the locality.

The trees enumerated in the following report are, with few exceptions, growing within the park, scattered over an extent of nearly a thousand acres. The soil varies a good deal in different parts, but is principally composed of sandy loam resting on shaley rock or slate. A more detailed description of the soil and situation will, however, be given where necessary as we proceed :—

Abies canadensis.

	Feet.	Inches.
Height of tree, ...	46	0
Girth of stem at 1 foot up, . . .	4	4
Girth of stem at 5 feet up, . . .	3	2
Diameter of spread of branches, . .	21	0

The drooping, plume-like habit of this tree renders it particularly suitable for planting as a single specimen on the lawn or pleasure ground. It prefers a moist, shady situation, and cool, light soil. The best tree of this kind (the dimensions of which

are given above) is growing in rich, peaty loam, with a northern aspect, on the outskirts of a plantation at some distance from the park. The wood is hard, of a pale yellow colour, and takes a good polish. Introduced in 1736 from North America.

ABIES DOUGLASII.

	Feet.	Inches.
No. 1.—Height of tree, ...	79	0
Girth of stem at 1 foot up, . . .	13	6
Girth of stem at 5 feet up, . . .	11	6
Diameter of spread of branches, . .	66	0
No. 2.—Height of tree, ...	70	0
Girth of stem at 1 foot up, . . .	13	0
Girth of stem at 5 feet up, . . .	11	0
Diameter of spread of branches, . .	51	0
No. 3.—Height of tree, ...	65	0
Girth of stem at 1 foot up, . . .	9	2
Girth of stem at 5 feet up, . . .	8	7
Diameter of spread of branches, . .	48	0

These trees are growing within a short distance of each other, and quite close to the carriage drive leading from the castle to the grand entrance. The position they occupy is rather exposed, and the leaders of all three have been repeatedly broken over by the wind. It is a striking fact that nearly all the Douglas firs here, on overtopping the surrounding trees, become table-headed from the repeated loss of leaders. Being of rapid growth, the young wood is not sufficiently hardy or matured to withstand a severe storm, and most of our trees of this kind being nursed up amongst others are naturally tender, so the leader on rising above the surrounding trees is apt to get broken over. I believe a plantation formed of this tree alone, or mixed up with others of an almost equal rate of growth, such as the silver fir, would succeed better, and be less liable to injury during a storm than when planted out as single specimens or mixed up amongst general forest trees. The timber grown here is hard and durable, susceptible to a fine polish, and is frequently used as spars in ship-building on the Menai Straits. It is heavy, firm, not liable to warp, and of as deep a colour as the yew. Introduced in 1826 from North-West America.

Abies Menziesii.

	Feet.	Inches.
Height of tree, ...	56	0
Girth of stem at 1 foot up, . . .	5	2
Girth of stem at 5 feet up, . . .	3	10
Diameter of spread of branches, . .	28	6

Standing on the lawn to the south-west of the castle, in a partially shaded position, this tree is in a very healthy and flourishing condition, its beautiful silvery appearance being a marked characteristic of this fir when grown in a suitable soil, such as a cool and rather heavy loam. On warm, sandy soils this tree is generally infested with red spider. From specimens of the wood preserved here, it appears similar in all respects to our common spruce. Introduced in 1831 from North-West America.

Abies morinda.*

	Feet.	Inches.
Height of tree, ...	43	0
Girth of stem at 1 foot up, . . .	5	5
Girth of stem at 5 feet up, . . .	3	8
Diameter of spread of branches, . .	24	0

Several handsome specimens of this tree are scattered throughout the grounds, the two largest occupying sheltered positions near the castle. On cold, late soils, or at high elevations, this tree succeeds best, as on low-lying or damp ground the young shoots are often killed by spring frosts. This species of spruce attains great perfection here, and as an ornamental tree its drooping foliage contrasts finely with those trees of a more stiff and rigid appearance. The timber is hard and the concentric rings firmly packed. Introduced in 1818 from Northern India.

Araucaria imbricata.

	Feet.	Inches.
Height of tree, ...	42	0
Girth of stem at 1 foot up, . . .	4	9
Girth of stem at 5 feet up, . . .	4	0
Diameter of spread of branches, . .	20	0

The symmetrical and picturesque form of this tree, combined with its noble proportions, justly entitle it to rank amongst the finest of the conifers. Planted on the lawn or pleasure ground it

* See Plate V.

forms a conspicuous object from the peculiarity of its construction, and is admirably adapted for standing alone, where it forms a beautiful pyramidal cone, densely covered with gracefully drooping, up-curved branches. A prevailing evil with this tree in many places is the loss of the lower branches, which is due in a great measure to planting it in low-lying, damp situations, or under the shade and drip of other trees. No tree more dislikes being overhung and shaded by others than the Araucaria, and nothing is more adverse to its healthy development.

Constitutionally there are great differences in trees of the Araucaria, some being naturally hardy, and others the reverse, due in a great measure, no doubt, to the altitude at which the seeds have been grown in their native country. The finest Araucarias are always found in well-drained ground on rather an exposed and airy situation; unreclaimed, wet land produces but poor specimens, and these very susceptible to the influence of frost.

Many fine specimens of this tree have been planted in the park and surrounding grounds, the healthy appearance and thriving condition of which proclaim it to be eminently adapted for our maritime situation. The wood is yellowish-white, fibrous, beautifully veined, and capable of being polished and worked with facility. Introduced in 1796 from Chili.

Cedrus deodara.

	Feet.	Inches.
Height of tree, ...	55	0
Girth of stem at 1 foot up, . . .	5	3
Girth of stem at 5 feet up, . . .	4	8
Diameter of spread of branches, . .	26	6

This tree is growing in stiff loamy soil, close to the sea at Port Penrhyn, and alongside a magnificent specimen of *Araucaria imbricata*. These trees contrast admirably, and are splendid examples of opposite styles of beauty. The Deodar seems to thrive in almost any soil, examples of which may be seen in the woodlands here, where it has been extensively planted. Introduced in 1831 from Northern India.

Cedrus Libani.

	Feet.	Inches.
No. 1.—Height of tree, ...	52	0
Girth of stem at 1 foot up, . . .	16	6
Girth of stem at 5 feet up, . . .	15	0
Diameter of spread of branches, . .	54	0

	Feet.	Inches.
No. 2.—Height of tree, ...	52	0
Girth of stem at 1 foot up, . . .	15	0
Girth of stem at 5 feet up, . . .	14	6
Diameter of spread of branches, . .	75	0

These are noble trees of a singularly massive appearance, and well fitted for adorning the positions they occupy. The branches, which spread horizontally to a width equal to the height of the tree, have a peculiar flat, shelf-like form, and having been at different times broken during severe storms, give to the trees an old and hoary appearance. Both trees are growing in rich loam—one at each end of the flower garden—and though partially sheltered, are at times subject to sudden gusts of wind, especially from the south-west. The wood, bark, cones, and even leaves of this tree are saturated with resin. Introduced before 1676 from Asia Minor.

The wood of both *Cedrus deodara* and *C. Libani* is durable, close grained, hard, and so resinous that the splinters burn like candles. I have compared wood of the cedars grown here with slabs of cedar sent from India, and can detect but little difference. The Indian slabs are certainly the harder, but this may be due to the wood being older, and consequently better matured. The colour and texture of the woods are much alike, and I find that the home-grown wood takes as fine a polish as the Indian.

Cunninghamia sinensis.

	Feet.	Inches.
Height of tree, ...	42	0
Girth of stem at 1 foot up, . . .	4	7
Girth of stem at 5 feet up, . . .	3	8
Diameter of spread of branches, . .	26	0

Although not generally hardy in Britain, especially in the north, fair specimens of this tree may occasionally be met with in the south and south-west of England. The above specimen is growing in cool, loamy soil, with a south-eastern aspect, in the flower garden. It is in a fairly healthy state, well clothed with bright green foliage, and is considered one of the finest trees of the kind in England. Sections of the wood grown on this estate resemble both in texture and colour those of *Araucaria imbricata*. Introduced in 1804 from Southern China.

CUPRESSUS LAMBERTIANA.

	Feet.	Inches.
Height of tree, ...	28	0
Girth of stem at 1 foot up, . . .	6	6
Girth of stem at 5 feet up, . . .	6	1
Diameter of spread of branches, . .	26	0

This is undoubtedly one of the most beautiful of the cypresses. The best tree on this estate is growing on the lawn at Brynmeirig, close to the Penrhyn Slate Quarries, on sandy loam, with a north-western aspect. It is a beautiful specimen, with light green pendulous branches, so closely packed that no part of the stem is visible, and, judging from its large size, must have been planted here shortly after its introduction in 1838. This tree bears stem and branch pruning with impunity. The wood is hard, close grained, and beautifully veined.

CUPRESSUS SEMPERVIRENS.

	Feet.	Inches.
Height of tree, ...	32	0
Girth of stem at 1 foot up, . . .	4	6
Girth of stem at 5 feet up, . . .	3	10
Diameter of spread of branches, . .	12	0

This beautiful upright cypress is among evergreens what the Lombardy poplar is among deciduous trees—a fine contrast to the more spreading and round-headed forms. Its deep evergreen branches and leaves render it a desirable tree for planting in graveyards or cemeteries; and owing to its fastigiate habit, it forms a suitable tree for planting near buildings where the prevailing architectural lines are horizontal. When judiciously placed along the margins of plantations, or among other conifers of a more spreading habit, its effect is strikingly beautiful. It succeeds best in a rather dry sheltered situation. The above tree is one of a group of eight growing on the lawn-tennis ground near the castle, and are all remarkable for the profusion of small cones with which the dark evergreen branches are almost constantly covered. Introduced prior to 1548.

PICEA GRANDIS.

	Feet.	Inches.
Height of tree, ...	66	0
Girth of stem at 1 foot up, . . .	5	5
Girth of stem at 5 feet up, . . .	5	4
Diameter of spread of branches, . .	30	6

Few of the Picea tribe on this estate are in a more healthy and

thriving condition, or seem better adapted for their seaside situation than this. When viewed from a distance, it closely resembles the Douglas fir, but has a more dense habit and majestic appearance. In well-sheltered situations, and on good loamy soil, it is one of the finest of Conifers for landscape effect. Being of rapid growth, the leader is very apt to get broken over during severe weather, which may be easily rectified by substituting a side branch in place of the lost leader. The stem is tall and very straight, and densely covered with bright green branches. This tree should be allowed ample room, for, if grown in close proximity to others, the foliage becomes sparse, and the whole tree assumes a sickly and naked appearance. Introduced in 1831 from North-West America.

Picea nobilis.

	Feet.	Inches.
Height of tree, ...	54	0
Girth of stem at 1 foot up, . . .	5	9
Girth of stem at 5 feet up, . . .	5	4
Diameter of spread of branches, . .	24	6

This is a magnificent tree, especially during summer when the light green of the young, and deeper green of the older foliage, is strikingly effective. It grows very rapidly here after becoming thoroughly established, soon shooting up to a great height, especially when planted in cool, deep soil. The wood is white and nearly worthless. Introduced in 1831 from North-West America.

Picea Nordmanniana.

	Feet.	Inches.
No. 1.—Height of tree, ...	54	0
Girth of stem at 1 foot up, . . .	6	0
Girth of stem at 5 feet up, . . .	5	2
Diameter of spread of branches, . .	24	0
No. 2.—Height of tree, ...	46	0
Girth of stem at 1 foot up, . . .	5	0
Girth of stem at 5 feet up, . . .	3	8
Diameter of spread of branches, . .	17	0

As an ornamental tree for landscape effect, few, if any, of the Conifers lately introduced into this country, can compare with this noble tree, either for beauty of outline, or the rich contrast produced in summer by the dark glossy green of the old, and the

light fresh lively tints of the younger, foliage. Whether planted on the lawn, or mixed with other trees for the sake of contrast and variety along the margins of plantations, it never fails to attract attention and produce the most pleasing effects. This tree is also capable of accommodating itself to a great variety of soils and situations; although like other species of Picea, it prefers a strong deep loam, rich in organic matter, and not apt to dry up in summer or retain too much moisture in winter. On the other hand, cold stiff clay and poor inorganic surface accumulations are inimical to its growth, more especially where the subsoil consists of hard pan. From the appearance of the timber of trees which I have cut up, there can be no doubt that it will possess the qualities, and sustain the reputation of the timber grown upon its native hills; it is hard, resinous, and the concentric rings firmly packed. No. 2 was planted in 1857 by Sir James M'Garel Hogg. Introduced in 1848 from the Crimea.

Picea Webbiana.

	Feet.	Inches.
Height of tree, ...	56	0
Girth of stem at 1 foot up, . . .	5	2
Girth of stem at 5 feet up, . . .	4	2
Diameter of spread of branches, . .	22	0

When in perfect health, the beautiful dark green leaves distinctly marked underneath with white or silvery stripes, and large prominent cones of a deep purple colour, contribute to make this tree perhaps the most ornamental of the genus. Unless planted in a rather cold, late soil, and sheltered position, it is subject to injury from unseasonable spring frosts, by which the young growths are frequently killed; more than a foot in length of many branches being almost destitute of leaves, and giving to the tree an unhealthy and miserable appearance. Our largest specimen, though not the finest, stands on the edge of a walk that winds along the Ogwen river. It is well sheltered from all parts, and is growing on rich, damp, vegetable mould.

Another specimen growing at Brynmeirig, near the Penrhyn Slate Quarry, though inferior in point of size to the above, has a more healthy and thriving appearance. It is growing on peaty loam, incumbent on slate rock, with a northern aspect. Introduced in 1822 from Northern India.

Pinus austriaca.

	Feet.	Inches.
Height of tree, ...	42	0
Girth of stem at 1 foot up, . . .	5	2
Girth of stem at 5 feet up, . . .	4	4
Diameter of spread of branches, . .	22	0

Perhaps few of the Pine tribe possess the many good qualities which can be attributed to this species. Whether for shelter, effect, adaptation to different soils and situations, or planting in maritime districts, it is invaluable. The timber is also tough, resinous, and well fitted for resisting the evil effects attending the change from a moist to a dry state. Around the margins of most of the seaside plantations here, this pine is extensively planted, as it not only withstands the rough sea breeze better than any other, and by its thick, strong foliage, renders a great amount of shelter to other less hardy kinds, but also, by its dark, glossy appearance, it presents a striking effect when viewed from a distance. Introduced in 1835 from Austria.

Pinus Cembra.

	Feet.	Inches.
Height of tree, ...	37	0
Girth of stem at 1 foot up, . . .	3	2
Girth of stem at 5 feet up, . . .	2	8
Diameter of spread of branches, . .	12	0

Being of but slow growth and recent introduction, none of this species has attained great dimensions here; but, from the healthy appearance of several planted out as single specimens in the park, as well as others interspersed through some of the general plantations, we anticipate much success with them. This pine also luxuriates in maritime districts; the two best specimens are standing within a few yards of the sea, though partially sheltered by a narrow strip of wood. It attains greatest perfection in a rich, deep, loamy soil, although many examples of fine growth may be seen here on thin, poor soils, and very exposed situations. The wood of this tree is soft, close grained, and easily worked; the heart-wood is of an agreeable light brown colour, resinous, durable, and fragrant. The well-known Swiss carved ornaments are made from this wood. Introduced about 1746.

Pinus excelsa.

	Feet.	Inches.
Height of tree, ...	45	0
Girth of stem at 1 foot up, . . .	4	2
Girth of stem at 5 feet up, . . .	3	6
Diameter of spread of branches, . .	24	0

The light silvery foliage of this pine renders it very desirable for contrast, especially along the outlines of plantations which can be seen from drives or roads. Mixed with the Austrian and other pines of a darker foliage along one of the carriage drives here, it has a very pleasing effect. In general appearance it bears a resemblance to the Weymouth pine (*P. Strobus*), from which, however, it is easily distinguished; the leaves are about double the length, the tree is of a more robust habit of growth, and the bark is much rougher than on that species. It requires to be planted in a rather sheltered position, as on exposed ground the foliage becomes scanty, and the tree stunted in appearance. The wood of specimens grown here is white and soft, though rather compact, and contains a great quantity of resin. Introduced about 1827 from the Himalaya.

Pinus laricio.

	Feet.	Inches.
Height of tree, ...	72	0
Girth of stem at 1 foot up, . . .	9	5
Girth of stem at 5 feet up, . . .	9	4
Diameter of spread of branches, . .	45	0

By neglect in early growth this tree was allowed to retain a plurality of leading shoots, two of which branch off at 7, and two at 11, feet from the ground, the largest of each girthing at 3 feet from point of junction 5 feet 11 inches and 5 feet 3 inches respectively. Each limb is perfectly straight, and would make a good-sized tree of itself. This pine thrives admirably here on almost any soil; and several, but little inferior to the one described, may be found scattered throughout the park and surrounding plantations. It is one of our best pines for breezy maritime situations, and deserves to be extensively cultivated, as, apart from its free growth and majestic appearance, the timber is quite equal to the red deal of commerce. Introduced in 1759 from Southern Europe.

Pinus pinaster.

	Feet.	Inches.
Height of tree, ...	62	0
Girth of stem at 1 foot up, . . .	12	0
Girth of stem at 5 feet up, . . .	12	0
Diameter of spread of branches, . .	42	0

This tree prefers an open and airy situation, and in the vicinity of the sea, where the temperature is to some extent equalised, it attains large dimensions. Planted among other trees, it has a tendency to grow crooked, produce large side-limbs, and if at all crowded, loses the foliage to near the top. The wood of the tree is soft, and of little value. Our largest tree, which stands in the flower garden, produces annually a large quantity of cones, from the seeds of which we have raised several lots of fine healthy plants, much more hardy, I have no doubt, than those raised from imported seeds. In raising this pine one thing should be particularly attended to—viz., that the young plants, if allowed to remain long in the nursery lines, must be frequently transplanted, as neglect of this generally proves fatal to the tree when planted out permanently. Introduced in 1596 from Southern Europe.

Sequoia sempervirens.

	Feet.	Inches.
No. 1.—Height of tree, ...	56	0
Girth of stem at 1 foot up, . . .	12	2
Girth of stem at 5 feet up, . . .	9	2
Diameter of spread of branches, . .	30	0
No. 2.—Height of tree, ...	64	0
Girth of stem at 1 foot up, . . .	8	2
Girth of stem at 5 feet up, . . .	6	7
Diameter of spread of branches, . .	24	0

No. 1 occupies a sheltered position within a few yards of the carriage drive leading from Penrhyn Castle to the model village of Llandegai. It is a beautiful specimen, richly clothed with glaucous green foliage from the ground upwards, but unfortunately during a severe storm, some five years ago, the leader was broken over, which is, however, being gradually replaced by a side branch.

No. 2 stands at a short distance from the above, on the sloping

ground near the Ogwen river. Being well sheltered on all sides, and growing in rich loamy soil, though attaining a great height, the girth of this specimen is not in proportion to those of a less rapid rate of growth.

This tree cannot be recommended for bleak or exposed situations, as, in consequence of its continuing to grow so late in the autumn, the young shoots are not sufficiently matured to stand our severe winters with impunity. From specimens of the wood contained in a collection of the different kinds grown on this estate, it appears close-grained and of a beautiful mahogany colour, though extremely light and brittle.

The Sequoia, or Redwood of California, has probably been overrated as a suitable tree for our climate generally, and apart from actual results it is not likely that a tree inhabiting one of the most genial climates in the world, and with ample opportunities of spreading into cooler regions near, would be suited for a cool northern climate.

Thuia Lobbii.

	Feet.	Inches.
Height of tree, ...	43	0
Girth of stem at 1 foot up, . . .	4	2
Girth of stem at 5 feet up, . . .	3	7
Diameter of spread of branches, . .	20	6

This is a handsome, fast-growing Conifer, with a smooth upright stem and long graceful branches, of a deep, shining, green colour. It is perfectly hardy, and grows rapidly when thoroughly established, and though shooting up to a great height in proportion to the thickness of the stem, it is not liable to be broken over, the young wood being naturally tough and able to resist the fiercest storm. It thrives best in a peaty loam, though many fine examples of rapid growth in pure loam may frequently be seen throughout the park.

In cutting the wood of the trunk of young trees I have found it to be of a firm texture, with the concentric rings firmly packed. A good deal has been said and written lately by practical men upon a substitute for the larch; and in my opinion *Thuia Lobbii* will be found one of the best, if not the very best Conifer for that purpose. Introduced in 1853 from North-West America.

WELLINGTONIA GIGANTEA.

	Feet.	Inches.
No. 1.—Height of tree, ...	53	0
Girth of stem at 1 foot up, . . .	10	1
Girth of stem at 5 feet up, . . .	7	8
Diameter of spread of branches, . .	22	0
No. 2.—Height of tree, ...	38	0
Girth of stem at 1 foot up, . . .	7	5
Girth of stem at 5 feet up, . . .	6	1
Diameter of spread of branches, . .	18	6

All the trees of this kind are in a very healthy and thriving condition, and seem well adapted for their maritime situation. The growth though rapid is strong and well matured, which is proved by this tree seldom loosing its leader or becoming damaged during a storm. The largest (No. 1), which grows close to the carriage drive, but nearer Llandegai than the trees already described, is a model of symmetry, with foliage of the richest description. It is growing in a rich sandy loam, well drained, and in a partially shaded position.

No. 2* was planted on the 17th October 1859, by Her Majesty The Queen, and has made an average yearly growth of 19½ inches. It grows on the lawn-tennis ground, between the castle and flower garden, where there is a collection of trees planted by Members of Royalty and other distinguished personages. The soil is shallow and incumbent on shaley rock. Here also is another Wellingtonia, planted in 1857 by Lady Hogg, which has attained a height of 55 feet, being an average yearly growth of nearly 26 inches. The wood of Wellingtonias grown on this estate is light, soft, and fragile, though easily worked, and in appearance resembles the "Cedar-wood" used for pencils. Introduced in 1853 from California, by Messrs Veitch & Sons, of Exeter and Chelsea, through their collector, William Lobb.

* See Plate VI.

INTERNATIONAL FORESTRY EXHIBITION, EDINBURGH, 1884.

The International Forestry Exhibition held in Edinburgh in 1884—the first of the kind in the British Empire—originated in a proposal made by some members of the Scottish Arboricultural Society in the spring of 1882; and the project was announced at the annual meeting of the Society that autumn, as recorded in the *Proceedings*. The proposal was at once taken up with enthusiasm by foresters at home and abroad, and especially by members of this Society. It received the generous patronage and support of Her Majesty The Queen, and the Royal Family; many foreign Princes and States; the Home, Indian, and Colonial Governments; the leading nobility and landowners of the United Kingdom; the Lord Provost and Town Council of Edinburgh; the Highland and Agricultural Society; and numerous learned, scientific, and industrial bodies throughout the country.

After the preliminary meetings were held under the auspices of this Society, and the matter fairly placed before the public, a large General Committee, including many influential members of the Society, was elected, with the Marquis of Lothian, K.T., *President*, to carry out the proposed Exhibition. Eventually, the direction and management devolved on an Executive Committee of thirteen members, presided over by the Marquis of Lothian. This Society was represented on the Executive by the *President* of the Society, Dr Cleghorn of Stravithie; two *ex-Presidents*, the Marquis of Lothian, and Robert Hutchison of Carlowrie; Colin J. Mackenzie of Portmore; and Malcolm Dunn and John Methven. The other members of the Executive were Sir James H. Gibson Craig, Bart., of Riccarton, *Vice-President;* Sir George Harrison, Lord Provost of Edinburgh; Fletcher N. Menzies, *Secretary*, Highland and Agricultural Society; John Murray, of the "Challenger" Expedition; William Skinner of Corra, W.S., Town Clerk of Edinburgh; James D. Park, Engineer; and James A. Wenley, Bank of Scotland, *Treasurer;* with Mr George Cadell, *Secretary*. Through the energy and excellent arrangement of the Executive, assisted by an efficient staff of officials, the exhibits, collected from almost every quarter of the world, were arranged for inspection by the day originally fixed on—the first of July—when the Exhibition was formally opened by the Marquis of Lothian, in the presence of a large and representative assemblage. During the three and a half

months it remained open, it was visited by upwards of half a million of people from all parts of the world, among the distinguished company being their Royal Highnesses the Prince and Princess of Wales, Prince Albert, Prince George, and the Princesses Louise, Victoria, and Maud of Wales; several foreign potentates; the Premier, Mr Gladstone; Sir Stafford Northcote, Bart., and many other eminent and distinguished men. The result was a great success, which must be particularly gratifying to the members of this Society, to whom is due the credit of the inception of the Exhibition. Its educational effects can hardly yet be fully estimated, but they have undoubtedly taken a deep hold of the public mind, and will in future prove a permanent benefit to the British Empire, as well as to all the foreign countries which participated in carrying into effect such an unique and comprehensive Exhibition of the Forest Products of the World.

The grounds of Donaldson's Hospital and an adjoining field at the west end of Edinburgh, extending to about 15 acres, were secured as a site for the Exhibition, and being easy of access by road, rail, and tramway, they proved admirable for the purpose. The space was laid out with a special view to facilitate the working of machinery and the proper display of the exhibits. On the spacious lawn in front of the Hospital, a handsome and commodious wooden building was erected, consisting of a grand gallery, with central, eastern, and western transepts, in which the most interesting collections were displayed. Three annexes, at the north end of the transepts, were chiefly occupied by a rich and varied display of trade exhibits. In the open field there were erected a neat wooden suite of offices for the accommodation of the Executive and official staff, and numerous buildings and enclosures for refreshments, storage, machinery in motion and stationary, and for the many other purposes demanded by such an Exhibition. There were also erected in the field numerous other buildings of an artistic and useful nature, such as Swiss châlets, rustic arbours, foresters' huts, and the like; among which The Queen's Scots Fir Châlet, or Summer-house, from Balmoral occupied a prominent position, and deservedly attracted a large share of public attention. The general arrangement of the Exhibition and grounds is seen from the plan appended hereto, for which the Society is indebted to Messrs T. & A. Constable, Edinburgh, the printers of the Official Catalogue, who have gratuitously supplied copies to illustrate this Report.

In the arrangement of the Exhibition, the Society was allotted about 2000 feet of space for its exhibits, in an excellent position in the main gallery and north-west transept, near to the principal entrance. Here it was enabled to display to great advantage a vast array of rare, valuable, and interesting articles contributed by the members, and from the Society's own collections acquired at various times during the thirty years it has been instituted. These are fully detailed at the end of this report. The arrangement was carried out with taste and skill by the *Secretary*, Mr John M'Laren, Jun., assisted by a special committee. To members of the Society and to the public generally, the Scottish Arboricultural Society's section was a centre of attraction from the opening to the close of the Exhibition—the numerous articles on the stands being examined with lively interest by the crowds that visited the Exhibition. The out-door display of the Society's exhibits was arranged on a convenient site near the machinery in motion, and contained many things of much interest, especially to foresters. Scattered through the Exhibition, inside and out, were also to be seen many valuable collections and articles exhibited by members of the Society, especially from landowners and their foresters; from the nursery and seed trade; and from the tool, implement, machinery, and fencing manufacturers.

Articles of every description connected with Forestry were exhibited in the buildings and grounds. These were contributed by almost every civilised country in the world, and included exhibits by The Queen, the Prince of Wales, the Duke of Edinburgh, several Government Departments, the Commissioners of H.M. Woods and Forests, the Government of India, the British Colonies, the Empire of Japan, and many other Foreign States, and a numerous and influential body of representatives of all classes at home and abroad.

It is much beyond the scope of such a limited report as this must necessarily be to give full details of any of the splendid collections of exhibits made by either States, Societies, or individuals; but it may be noted that the collections exhibited by The Queen, the British Government, the Scottish Arboricultural Society, India, Japan, Guiana, Ceylon, Johore, Denmark, Sweden and Norway, Cape of Good Hope, and New Brunswick, contained the cream of the Exhibition.

Britain.

In proceeding to give the following slight sketch of the principal exhibits, those claim the first notice which were sent by Her Majesty The Queen, who not only graciously allowed her name to appear among the list of Patrons, but took a lively interest otherwise in the Exhibition. From the Royal Forests on Deeside, in the conserving of which Her Majesty has set so excellent an example, came admirable specimens of the wood of *Pinus sylvestris* —the indigenous Scots Fir—which still flourishes in the Ballochbuie forest in all its pristine grandeur. Part of the wood had been worked up into an artistically designed rustic Châlet, the interior of which was beautifully finished in dressed Scots fir, the furniture being also of the same wood, all varnished with clear transparent copal, which showed to excellent effect the fine grain and beautiful swirl of this timber. The Châlet, which was wholly constructed of and furnished with Native Scots Fir, even to the "thatch" of the roof (which was formed of Scots fir bark), looked both picturesque and appropriate; and the whole formed in itself one of the most attractive features of the Exhibition. Several fine sections of Scots fir timber in its rough state, ranging from 212 to 270 years old—excellent alike as to size and quality—were also displayed around the Châlet. The trunk of one of these "monarchs of the forest" had lain on the ground for upwards of 40 years, and in that time its sapwood had become wasted into a mould in which were growing heather, cranberry, and blaeberry bushes, and mosses; while the heartwood, measuring 3½ feet across, was perfectly sound. An eminently practical part of the Royal exhibit were specimens of the soil in which Scots firs not only grow, but thrive in upper Deeside. One of these consisted of different strata of dry ferruginous gravel, with about 4 inches of peaty turf atop; the other, a mass of crumbled granite, having a small proportion of decomposed vegetable matter mixed with it. The first of these soils is, in most respects, similar to that of the great area of waste lands in Scotland; and one of the objects Her Majesty is understood to have had in view in sending these Balmoral exhibits, was to encourage the planting of waste lands with Scots firs.

To their Royal Highnesses the Prince of Wales and the Duke of Edinburgh, the Exhibition was indebted for a splendid collec-

tion of hunting trophies from India and other countries; and several noblemen and gentlemen, including Colonel Michael, the Indian Commissioner, also lent similar specimens, which appropriately decorated the interior of the grand gallery.

The Commissioners of Woods and Forests—the public department for the management of the State forests and woodlands in this country—sent exhibits of much every-day interest to foresters. It may be noted in passing that the Woods and Forests under the charge of Her Majesty's Commissioners amount in the aggregate to about 100,000 acres. Oak is largely grown in these woods, and there were sent for exhibition from the New Forest, in Hampshire, sections of this characteristic English tree, from 10 to 200 years old, showing the growth of the timber under varying circumstances of soil, and illustrating also the ravages of disease and the results of checking the same at an early stage; while from the Dean Forest—of which Sir James Campbell, Bart., has had the direction for many years—were sent a splendid collection of sections, and illustrative specimens of woods, accompanied by an elaborate chart, recording the comparative growth of oaks transplanted and not transplanted. These experiments had been carried on from the year 1809, and the transplanted oaks showed considerably the best results. The exhibits from Windsor Forest were also of a valuable and representative character, combined with much historical interest.

Oak bark illustrative of various methods of curing, sections of wood showing the devastation worked by insects and the bad effects of encumbering a tree with dead branches, specimens exhibiting the results of good and bad pruning, various kinds of gates and fences in use in the Royal Forests, timber waggons and other modes of transport, and a collection of forestry tools, mostly of somewhat primitive make, were also among the exhibits sent by Her Majesty's Commissioners.

The Secretary for War sent a valuable and instructive collection of exhibits from H.M. War Department, consisting of fine specimens of the various woods used in the manufacture of Gunpowder and samples of the charcoal made from them; sections of the different timbers used in the construction of Gun-Carriages, and for other Ordnance purposes; specimens of Rifle Stocks and Lance Shafts in several stages of manufacture; and a variety of other articles used for purposes of war.

India.

The magnificent exhibits from our great Indian Empire, both in respect to scientific and practical value, received from visitors that amount of attention they so well deserved. They formed a pleasing illustration to arboriculturists in this country of the progress of the science in India, where its application was so much needed, and in which it has so wide a field to work. The Department of Forestry, which was organised less than thirty years ago by the East India Company, in which the *President* of this Society, Dr Cleghorn, took a leading part, has now grown into a great State Department, whose work is exerting an ameliorative influence on the climatic and physical conditions of the country. Not only are the splendid forests of India—the present reserved area being no less than 46,000 square miles in extent—systematically managed and made to yield a handsome revenue, but there are also extensive nurseries and plantations in which trees are raised for the afforesting of treeless districts. Tree planting is being pushed northwards and westwards towards the Afghanistan and Beloochistan frontiers, and it is most instructive to hear that, as a direct result of such operations, the rainfall in these arid lands is gradually increasing. Occupying the whole of the south-central transept and several bays on each side, the Indian Collection, which was under the care of Colonel Michael, was by far the largest and most valuable in the building. Included in it was the Calcutta "Index Collection" of Museum Specimens, alphabetically arranged, and including about 800 examples of the trees of India, which grow in the vast territory between Cape Comorin and the snow-capped Himalaya. The Bombay exhibits, consisting for the most part of sections of useful and ornamental woods, were chiefly remarkable for the skilful manner in which they had been cut so as to show the different grainings and qualities, and the appearance which the wood presented in a rough state and when dressed and varnished. The contribution from British Burmah included a number of grand bamboos 85 feet in length, and some splendid logs of teak (*Tectona grandis*), which there attains to a great size. Of unexcelled durability, the wood is largely exported to this country for ship and railway carriage building purposes; and the uses to which it is put by the cabinet-maker and wood-carver were exemplified in beautiful carved panels

and in articles of furniture and interior decoration. The "Blackwood" (*Dalbergia latifolia*), another valuable tree, had also been worked up in the same admirable manner. The "Sissoo" (*Dalbergia Sissoo*) is a tree little known to outside commerce, but it has tough enduring qualities which fit it for Ordnance purposes. Gun carriages, with wheels made of "Sissoo," stood the wear and tear of the last Afghanistan campaign, and came back without, it is said, a single break-down having been recorded. The Andaman and Nicobar Islands were well represented by splendid logs of "Padouk" (*Pterocarpus indicus*), the colour of the timber varying in different trees from that of cedar to dark mahogany; and by examples of the tree known by the natives as "Poon" (*Calophyllum inophyllum*), one slab of which, beautifully polished, surpassed in size everything cut in the same manner in the Exhibition. Travancore sent some remarkably fine ebony, and the capabilities of our Indian Empire for the production of gums, resins, oils, medicinal barks, dye stuffs, and other useful products, were abundantly illustrated, and suggested the possibility of further trade in these and many other articles with our great Eastern Dependency. To the ordinary visitor a very pleasing part of the Indian collection was the beautiful display of carved work in ivory and wood, and the cases of native curiosities from the Punjab and other districts.

Japan.

The most notable, perhaps, of all the contributions from beyond the seas, was the extremely interesting, varied, and complete collection of forestry subjects sent from far-off Japan, which filled the whole of the eastern transept of the Exhibition. This wonderful Collection of Forest Exhibits excited the interest and commanded the admiration of all, and clearly demonstrated what rapid progress the Japanese are making in the science and art of forestry. It says much for the enlightenment and enterprise of the Japanese, that the government of a country which twenty years ago was jealously shut against all foreign intercourse, should have been one of the largest exhibitors in an International Forestry Exhibition held in the capital of Scotland. They also recognised their sense of the importance of the Exhibition by sending over as Commissioner one of their chief forestry officers, M. Tokai, whose methods of arranging and

cataloguing the collection were admirable. Extending, as it does, over 15 degrees of latitude, the "Island Empire" of Japan possesses a Flora common to both tropical and temperate zones. The rural arts have long had their home there, and none have attained to more perfection in the grafting and dwarfing of trees and shrubs than the Japanese. Scientific forestry has now been regarded as of sufficient importance to be taken in hand by the State, and four years ago a School of Forestry was established, in which instruction is given to pupils by Japanese officials who have studied in the forestry schools of Germany. The curriculum in the forestry school includes botany, chemistry of the soil, natural philosophy, land surveying, and the practical work of planting and rearing trees. Attending the forestry school are about 150 pupils fitting themselves for work in the Government forests, while other pupils are the sons of landowners and farmers acquiring a scientific knowledge of arboriculture, in order to qualify them for managing their own lands. Japan, it will thus be seen, is ahead of Britain in this matter; and when the British Forest School is established, it will be well for it, and for the country, if it can draw its pupils from the same classes as attend for instruction in Japan. The Government forests of the "Island Empire" are now under strict regulations, and are worked on a systematic principle; plantations have been formed both for the rearing of native and foreign trees; and the charts which were so profusely hung around the walls of the court showed how carefully the forest surveys were being made. One of the charts by a native arboriculturist, showed the empire mapped out into five different tree regions—the first consisting of the zone of high temperature, with tropical evergreen trees, of which *Ficus Wightiana* was given as the typical example. In the temperate parts were the oaks and beeches and cedars, and the whole tribe of Thuias and Retinosporas, for which Japan is so famous; while in the upper regions, as at home, is the habitat of the pines and firs—the handsome *Abies Veitchii* being the representative of the mountain trees. The walls were also covered with photographs and pictures of forest scenes, illustrative of the manner in which trees are cut and transported from the higher to the lower regions, while on the tables were numerous and most ingenious models of contrivances for causing artificial floods on small rivers for the transport of timber, and of shoots—"Sadies"—for sending the timber down steep and rugged mountain sides. In the

Japanese collection were included no fewer than 302 specimens of useful and ornamental woods, many of rare beauty and value. Since the days of Siebold, Fortune, and Veitch, the beautiful Retinosporas and Cryptomerias of Japan, with their graceful habits and feathery foliage, have formed an effective feature in our lawn decorations, and also in ornamental plantations; but few were prepared to see that the members of the Arbor-vitæ family in their own home attained to such gigantic dimensions. Here, for example, was a splendid slab of wood from a *Retinospora obtusa*, which had stood 120 feet high, with a girth of 20 feet; and there were sections of the timber of *Cryptomeria Japonica*, which had been taken from trees of stately dimensions. Most lovely slabs of "camphor wood" (*Cinnamomum camphora*) with swirled grain were shown, as also pretty examples of maple and bird-cherry, junipers and yews. There are six or seven varieties of oak grown in Japan, the timber of which, though not equal to that of the English oak, is, nevertheless, of excellent quality. A characteristic of the timber of the great Japanese tribe of Conifers is its fine even quality, close grain, and absence of faults—features which make it valuable for all kinds of wood-work. The collection made it clear that the Japanese are excellent wood workers and carvers. There was an excellent display of their inimitable lacquer-work, also numerous examples of cooperage, wickerwork, and other manufactured wooden goods, all displaying much taste in design and great excellence in workmanship. Of much practical interest were the clever models of charcoal kilns, with numerous specimens of charcoal made in such kilns from various kinds of wood. The collection of scientific instruments, as well as of the tools and implements used in the Japanese forests, was of the greatest interest to British foresters, who culled many useful ideas from an inspection of them, although in many cases the shape and size of the articles were of a rather primitive nature, and not at all equal to our own tools and implements of the same kind.

Guiana.

Next in order may be mentioned the grand display of Forest Products exhibited by the Colony of British Guiana, which had the whole of the northern part of the central transept and part of the main gallery devoted to its accommodation, and

was even then much too crowded to properly display many of the rare and valuable articles of which it consisted. However, it was admirably arranged, considering the confined space, under the direction of Dr Russell, the Commissioner for the Colony, assisted most efficiently by Dr Imlach; and alike from a scientific and popular point of view, there was no more attractive court in the Exhibition. The primeval forests of the valleys of the Essequibo, the Demerara, the Berbice, and the Corentyn abound in splendid marketable timber. The monarch of these South American solitudes is the "Mora" (*Mora excelsa*, of Bentham), which is said often to attain to a height of 300 feet, and a girth of 18 feet. The wood of this tree is hard and teak-like in texture, and has been found especially suitable for railway sleepers in warm countries. "Green-heart" (*Nectandra Rodiæi*), various "Cedars," and other furniture woods are in abundance—one new timber specially brought under notice being a resinous wood called "Wallaba" (*Eperua falcata*), which has been found very serviceable for all kinds of cooper-work. Several very fine specimens were exhibited of the rare and costly "Letter-wood" (*Brosimum Aubletii*), so much sought after for inlaying and such purposes. One peculiar tree shown, named "Yarooro" (*Aspidosperma excelsa*), grows in shape like a deeply fluted column, and is said to be greatly in request by the Indians for making paddles. Cutting off one of the flutings, they have almost a paddle ready made, and having no cross grain, the wood is very durable. Specimens of the timber of over 100 trees were included in the collection, the sections shown being all of a substantial, many of them of a great size. Of the parasites and fungi of woods there was a large and varied representation, presenting a wide field for the study of the botanist — the fungi of British Guiana being as yet undescribed. The country was also shown to be exceedingly rich in fibre-bearing plants, among these being a very serviceable cotton, which is used by the Indians for various purposes. The collection was rich in specimens of what may be called the curiosities of a tropical forest, not the least instructive of which were the illustrations of the life and habits of the Indians of these parts. The collection of medicinal barks was a numerous and interesting one, and contained several kinds likely to prove valuable in pharmacy. A large and varied collection of the tree and other seeds of the colony were exhibited, but as only the vernacular names were

attached to most of them, they were more curious than useful. The collection of gums and resins was also of a valuable and interesting nature, and contained some remarkably fine specimens. Vegetable oils, dyes, bitters, etc., were well represented. Various kinds of palm woods and articles manufactured therefrom attracted much attention, especially the articles manufactured by the Indians, including houses, furniture, canoes, basket-work, etc., in most of which palm predominated in one shape or another. An Indian punt, designed for transporting the heavy greenheart timber down the rivers of the colony to the seaports, was particularly noteworthy for the excellency of its construction and general adaptability. On the whole the display was in the highest degree creditable to the colony, and to the skill and enterprise of those who collected, arranged, and managed it.

St Vincent and Tobago.

Alongside of the British Guiana exhibits there were arranged two very interesting collections from the West India islands of St Vincent and Tobago. These collections were also managed and arranged by Dr Russell and Dr Imlach, and in the case of the island of St Vincent the display was most comprehensive and instructive. Bamboos in great variety and articles made from them; cross and length sections of timbers, mostly of excellent quality and suitable for all sorts of purposes up to the finest cabinet work; capital models of foresters' huts, boats, rafts; neat basket work; fibres of great variety and fineness; gums, seeds, dried fruits, preserves, pickles, and a multitude of other articles of a useful or ornamental nature, made up a wonderful collection from such a small island. The collection from Tobago included many curious articles used as household utensils and for fancy purposes by the natives; and a good display of wood sections showing the fine grain and durable qualities of many of the forest trees of the island.

Ceylon.

Adjoining the Indian Court was an excellent representative Collection of the Forest Products of Ceylon, which had been got

together through the enterprise of one of its planters and a member of the Scottish Arboricultural Society—Mr J. Alexander, of Kirklees, Udapussallawa, Ceylon. It included, among a great variety of useful and artistic articles, upwards of 230 specimens of the wood of forest trees, conspicuous among which were some beautiful samples of the valuable satinwood, and also some very fine specimens of cocoa-nut wood. The various methods by which the valuable bark of the cinchona tree (the quinine of commerce) is harvested and prepared for market, was clearly illustrated in the most complete detail. Of this valuable medicinal bark as much as 7,000,000 lbs. were exported in 1883—the industry being one of the most remunerative that Ceylon possesses. Of the products and uses of the Cocoa-nut Palm, about 80 examples were shown; of the Palmyra Palm, about 160; and of the Talipot Palm, a numerous collection. Bamboos, Basket-work, Barks, Oils, Resins, Seeds, Fibres, and other forest products were exhibited in great abundance; and the Collection was also rich in Ceylon forest and plantation literature, and illustrations of life and scenery in Ceylon.

Johore.

Hard by the Ceylon exhibits was an admirable collection in charge of Mr James Meldrum, Commissioner for that enlightened Eastern Prince, the Maharajah of Johore, which is a richly wooded State in the Malay Peninsula. It included about 350 specimens of indigenous timber trees, and a great variety of instructive samples of the forest produce of that most productive country. Among these were fine examples of camphor, gum, gambier, and gutta-percha, Johore having been the first place from which the latter commodity was exported to this country. The Maharajah is a great woodman, and beautiful models of timber rafts, photographs of his sawmills, and sets of Malayan forestry implements were displayed.

Perak, Singapore, and Siam.

From the State of Perak, and from the island of Singapore lying to the south of the peninsula, came specimens of indigenous trees, chief among which were the "Seriah" (*Hopea*), the Johore

teak, and the "Tampinnis," the last mentioned being especially valuable to the builder in the tropics, as it is proof against the attack of white ants. Siam—the land of the white elephant—sent over 500 sections of trees under their native names, among the more important being teak, sandalwood, rosewood, and ebony.

Borneo.

From the large and interesting island of Borneo there were exhibited about fifty kinds of timber grown in the forests of the island, accompanied by their leaves and flowers, by means of which botanists could identify most of them. Samples of the axes used by the natives in felling the trees were also shown. These axes, or "billyongs" as they are termed, in various shapes and sizes, are in general use in Eastern countries, and are excellent tools in the hand of a native, whose physical powers are totally unable to swing the heavy felling axes of Western nations.

Mauritius.

The picturesque and richly clothed island of Mauritius, situated in the midst of the Indian Ocean, and more famous for its sugar plantations than its forests in recent times, exhibited fine specimens of about seventy of the woods grown in the island, a few of which have been introduced, but the great majority are indigenous. Many of them exhibited a fine close grain and superior quality, and would be found useful in high class wood work. Some excellent samples of indiarubber, from trees grown in the Colony, were also exhibited; and the most extensive and complete Collection of Fibres shown in the Exhibition came from the Mauritius. Among the fibres were several of a smooth silky nature and fine staple, which would be highly valued by manufacturers of soft goods if the raw material can be grown in quantity at a moderate cost.

Australia.

The large colonies of Australia contributed comparatively little to the Exhibition. This was the more to be regretted considering the number of valuable timber trees indigenous to them, and the

importance which forest conservancy is rapidly assuming in these colonies. The gums (*Eucalyptus*) and their products alone would have made an interesting exhibition, especially the typical Australian tree—the blue gum (*Eucalyptus globulus*)—which has been so largely planted, with exceedingly satisfactory results, in so many malarious districts in the warmer parts of the world. The South Australian Government, however, exhibited a number of interesting books and plates illustrative of its forest flora, and reports and plans of the management of its forest areas, which are now under a regular system of forest conservancy.

From the Royal Gardens at Kew, London, there was sent by Sir Joseph Hooker an excellent Collection of Australian Woods, including many large and beautiful specimens, and embracing all the best known and most popular kinds indigenous to these and the adjacent colonies of Tasmania and New Zealand, which to a certain extent made up for the paucity of exhibits sent direct from Australia.

Cape Colony.

Other portions of the British Empire which came well to the front were our African Colonies—Cape of Good Hope, Natal, Gambia, and Sierra Leone. The Cape Colony has been sadly denuded of its primeval forests, and the best timbered parts now existing are situated in the mountainous region of Knysna, in the south-eastern district of the Colony. The forests have a coast-line of about 100 miles, with an average breadth of 25 miles. Recently the Cape Government have adopted very stringent measures of conservation to prevent the wasteful destruction going on, which threatened to lead at an early day to the total deforesting of the country. The forests are in process of being surveyed, so that they may be worked on a principle of rotation, and protective measures have also been taken against fires. Premiums of a substantial amount have been offered to private parties who will plant a certain number of trees; Government plantations have been formed on the Cape flats and other waste lands; and nurseries have been established in which saplings are reared for the filling of gaps in the Crown forests, or for selling to private planters at a cheap rate.

Among the indigenous trees of the Cape—of which specimens were shown—were the Cape "Yellow-wood" (*Podocarpus Thunbergii*), very suitable for waggon building; the "Stinkwood" (*Oreodaphne bullata*), largely used in the manufacture of furniture, its colour and graining being good; and the "Sneezewood" (*Pteroxylon utile*), which is of great specific gravity, and, like the greenheart of Guiana, capable of withstanding the attacks of marine boring worms. Specimens of Cape box-tree (*Celastrus buxifolius*) were recommended to notice as likely to answer well in connection with the art of wood engraving. In all, there were exhibited specimens of the wood of forty-five kinds of trees grown in the Colony.

No wood is at present exported from Cape Colony, as more is required than the home-growth can supply. What is imported is chiefly in the shape of Norway deals, which it seems can be sold at Cape Town cheaper than the indigenous timber of the country, so great is the cost of transport, etc., from the Knysna forests.

There were also shown in the Cape collection a capital model of a Timber Waggon, simply and efficiently constructed to render it safe for transporting heavy loads over rough ground and through African "kloofs" or ravines,—impassable by any less strongly-built vehicle,—and found particularly serviceable for "Transport riding" over the hot, dry Karroo country of South Africa. The Commissioners who represented the Cape Colony at the Exhibition were The Hon. Robert Southey, C.M.G., of the Cape of Good Hope, and Charles D. Steuart of Dalguise, Perthshire, by whose efforts the collection was made one of the most interesting to visitors of any of its class in the Exhibition.

Natal.

The collection of exhibits from Natal was interesting, although not very large. It was chiefly contributed by a member of this Society, David M. Smythe, yr. of Methven, Perthshire, and consisted of Specimens of the Woods of the Colony, several of which seemed to be of considerable value for cabinet-making and higher-class woodwork; and of botanical specimens of the Forest Flora of Natal.

Gambia.

The Government of the Colony of Gambia had an extremely creditable display, consisting of a large number of specimens of native woods and samples of fibres, some of which are likely to prove valuable in commerce. These, with models of boats and native canoes; models of native huts; and a great variety of native furniture, household utensils, personal ornaments, and curiosities, made up a very attractive exhibition. This collection was also rich in tropical forest products, containing many fine samples of gums, resins, vegetable oils, seeds, indiarubber, and indigo, as well as honey, Indian corn, rice, and other articles of food.

Sierra Leone.

From Sierra Leone there were sent by the Government of the Colony a fine collection of the Forest products of that rich but unhealthy climate, consisting of, among other things, a good display of specimens of the woods of the country, with many fine samples of cotton and other fibrous substances, tanning barks, indiarubber, indigo, and wickerwork. Like the Gambia collection, this was also distinguished by the numerous articles it contained illustrative of the life, habits, and customs of the savage races who are still beyond the pale of modern civilisation. These tropical African collections showed what a mine of wealth still lies undeveloped in the grand forests and rich lands of the "Dark Continent," from which we may expect to reap an abundant commercial harvest in the not distant future.

Canada and New Brunswick.

Among our North American colonies, New Brunswick was the only one represented to any extent at the Exhibition; the Commissioner in charge of its exhibits, Mr Edward Jack, also displayed in the Court a few good exhibits of forest produce and other articles from various parts of the Dominion of Canada. New Brunswick is one of the oldest colonies on the Atlantic seaboard, and its virgin forests—though giving way before the advance of the agriculturist — are still of great extent and

value; but, according to the testimony of the Commissioner, they are sadly in want of conservation. There were exhibited many excellent specimens of the native hardwoods, chiefly shown in the form of polished panels; all possessing the characteristic of remarkably light colour. The examples of ash, bird's-eye maple, and birch were particularly fine. On the wall of this Court was displayed a large and most interesting map—the only contribution of the Dominion Government—on which was marked the limits of the Forest trees of Canada, by Dr Robert Bell, Assistant Director of the Canadian Geological Survey. It appeared that the trees of the higher zones were the spruce, larch, and balsam poplar, their limit being marked at about 65° N.L.

A nicely got up collection of forest tree seeds, indigenous to the Province of Quebec, along with beautifully executed coloured illustrations of the flowers and foliage of each tree, by Miss E. M. Jack, of Quebec, were also exhibited in the New Brunswick Court.

Manitoba.

No more instructive and interesting exhibit, from a practical point of view, was displayed than that sent from Manitoba. It showed the complete buildings of a Far West farm, all constructed of wood grown in the forests of the Colony. Wooden implements and utensils for farm, dairy, and domestic use were exhibited in great variety, and showed strength combined with lightness in a high degree. "Snake" and other fences in vogue on the prairies, were also a feature in this collection, from which the practical forester, as well as the intending emigrant, might have derived many a useful lesson. There were also exhibited specimens of about forty varieties of the timber indigenous to the North West and the Rocky Mountains, many of the sections displaying great size and fine quality.

California.

From another famous timber tree region in the New World came a most interesting representation of the gigantic "Redwood" tree (*Sequoia sempervirens*) of the country to the north of the

"Golden Gate" of California along the Pacific coast towards Oregon.

We are told that in the district of Eureka, redwood trees of 10, 12, or 20 feet in diameter are common, with straight boles rising to the height of 150 or 200 feet before a single branch is thrown out. A section of a giant redwood tree, 13 feet in diameter, was conspicuously displayed under the western dome of the Exhibition, where it attracted the attention of every one. Of the many uses to which its valuable timber may be put, there was a beautiful illustration in a cabinet trophy in the adjoining transept, as well as the splendid redwood châlet erected in the grounds.

Florida.

Nor must it be forgotten to mention the beautiful exhibits of curled pitch pine and pencil "cedar" wood sent from Florida,—that paradise of our American cousins,—the grand primeval forests of which are still to a large extent intact from the tree-destroying lumberman of the Northern States; although the Flowery Land is now threatened with timber "booms," which will quickly clear it of its trees, if precautions to prevent such a calamity are not taken in time.

The contributions from other States and countries of the Western Hemisphere were confined to the exhibits of private individuals; and although many of them were of a useful and instructive nature, and comprised numerous rare and curious articles, none were so specially prominent as to call for further remark.

Cyprus.

The only British possession in Europe, outside of the United Kingdom, which contributed a Collection of Forest products was the recently acquired island of Cyprus. These were sent by Mr Edward Dobbs, Chief Forest Officer, and comprised a numerous display of the woods produced in the island, including fine specimens of the Aleppo and Corsican pines, the principal timber-producing trees of the country; several species of pine cones and seeds; specimens of resins extracted from the pines; tanning

substances; branches of juniper and myrtle used in the island as materials for making baskets; and ropes for certain useful purposes requiring strength more than neatness. The collection, as a whole, augured well for the future of the forests of the colony, which are now managed under a proper system of forest conservancy.

Among European countries, Denmark and Scandinavia displayed the most important collections, contributing a great variety of excellent timber, cut and planed to show its fine quality, and the many useful purposes for which it is adapted.

Denmark.

In the Danish Court there were exhibited a numerous assortment of turned-wood goods, household utensils, wheelwrights' materials, and other wood articles of a useful nature, all showing excellent material, good workmanship, and skilful design. Scientific instruments, forest tools and implements were also a notable feature of the Danish exhibits; the collection being equal, if not superior, to anything of the kind in the Exhibition. Maps, plans, and diagrams illustrative of forests and forest economy, as well as a choice selection of forest literature, lent an additional interest to the Danish court. The kingdom of Denmark does not export timber, owing to its forests having become greatly exhausted, but it is satisfactory to learn that a more systematic management has now been introduced, which is working with good effect in the restoration of the forests, and in several parts of the country extensive planting operations are being carried on.

Scandinavia.

A conspicuous object among the Swedish and Norwegian exhibits was the splendid collection of dressed boards, which formed a colonnade of gigantic fluted pillars along the north side of the grand gallery. Planed goods of a varied description, cooperage,

house fittings, and other manufactured wooden goods, showed what these northern regions can do in supplying other countries with these useful articles. Nor must mention be omitted of a capital model of a raft, with a series of illustrations of the method of transporting timber, by both land and water, from the forests in Norway to the seaports; and also of fine samples of forest tree seeds and vigorous hardy-looking plants of forest trees.

Wood-Paper Exhibits.

Chiefly to Continental, but also to a few British exhibitors, the Exhibition was indebted for the finest display of wood paper-making material, and its various processes of manufacture, that has ever been seen. The wood-paper exhibits occupied a considerable space in the central portion of the grand gallery, and formed an object of much interest and attraction to visitors, the process being as yet a novelty in this country. The results of several methods of manufacturing the pulp were shown in detail, and also the various descriptions of paper made therefrom. The wood of the Norway spruce is that chiefly used, although paper can be made easily from any soft wood.

Loan Collections.

There was much of an interesting and instructive nature to the practical forester in the numerous Loan Collections which occupied such a large extent of space in the Exhibition, but mention can only be made here of a very few of the most notable. Professor C. V. Riely, of the United States Agricultural Department, exhibited a number of large cases of insects injurious to forest trees, which, though they had been somewhat roughly used in the transit, were perfectly illustrative of the subject, and showed remarkable skill and neatness in preserving and mounting the specimens. He also sent copies of his valuable works on the Entomology of the United States, and of his Entomological Reports to the Agricultural Department, all of which give a singularly clear exposition of the life-history of the insect pests of the States, and the best methods of dealing with them.

The botanical specimens, cones, woods, and other objects illus-

trative of the forest trees and forest flora of British Columbia, California, Mexico, India, China, Japan, and other parts of the world, exhibited by Messrs Veitch & Sons, of Chelsea, were of much scientific value and of the greatest interest to arborists and foresters, as many of them were the original specimens collected by the travellers who discovered the trees in their native habitats; or were unique of their kind, from their rarity and historical associations.

The remarkably complete and exceedingly interesting collection of woodpeckers, exhibited by R. G. Wardlaw Ramsay of Whitehill, Midlothian, also deserves special mention. The display of those "friends of the forester" was of a peculiarly instructive nature, and showed what a great variety of these birds inhabit the forests of the world, and aid man in keeping in check the inroads of destructive insects on our forest trees.

The splendid display of Sporting Trophies, Heads of Forest Animals, etc., collected for the Exhibition by Colonel Michael, C.S.I., the veteran "Shikari," were a feature of the greatest attraction in the Indian Court, where they were arranged on the walls with great effect, and showed the results of British pluck and endurance in many hazardous enterprises.

Exhibits in the Open Air.

In the open-air department of the Exhibition, British Nurserymen vied with each other as to who should exhibit the rarest and finest specimens of trees and shrubs, and more especially of Conifers. Prominent among these was the rare and choice collection of ornamental trees and shrubs exhibited by Messrs James Veitch and Sons, of Chelsea, London, which contained the finest plant in Britain of the "Umbrella Pine" (*Sciadopitys verticillata*) of Japan, and many other specimens of great merit. The grand displays made of beautiful trees and shrubs by the Lawson Nursery Company, and Messrs Thomas Methven & Sons, of Edinburgh, were the admiration of every one, and showed great taste and skill in the choice and arrangement of the various plants so as to give the best effect. Especially was this to be observed in the tastefully laid-out ground in front of Her Majesty's Châlet, which was occupied by the Messrs Methven and Sons' collection; the arrangement of the shapes and sizes of

the plants, and the blending of colours, being most charmingly executed. The collections exhibited by Messrs Little & Ballantyne, of Carlisle, and Messrs James Dickson & Sons, of Chester, were both numerous and highly meritorious, being specially rich in large examples of Conifers. The numerous other collections of trees and shrubs exhibited by our nurserymen added immensely to the attractions of the Exhibition grounds, each possessing some special merits, which were not overlooked by the crowds of visitors who so carefully inspected them.

Besides the outside exhibits, most of the leading nurserymen had large and splendidly equipped stands in the Exhibition building. Here Messrs Vilmorin, Andrieux, & Co., of Paris, exhibited one of the finest and most complete collections of seeds of trees and shrubs (comprising some 625 varieties) that has ever been shown at any exhibition, as well as about 350 varieties of cones, and a large and varied assortment of barks for tanning, woods, and other articles of a similar nature of great interest to foresters. The Lawson Nursery Company had something of a like display on a smaller scale; specially noteworthy being the set of beautiful plates of Lawson's *Pinetum Britannicum* which adorned the walls. Messrs Methven & Sons made a capital exhibition of forest tools and seeds; Messrs Little & Ballantyne, Carlisle, exhibited an interesting collection of woods, cones, seeds, and tools; and Messrs James Dickson & Sons, Chester, contributed an equally interesting stand of these articles.

Near the nurserymen's stands in the north-west annexe were the principal exhibits of the forest tool and implement manufacturers. Messrs Alex. Mathieson & Son, of Glasgow, displayed an extensive assortment of tools and wood-working machines, all of the best make and the newest design; every machine perfect in itself, and fitted to a nicety. The Sheffield firm of tool manufacturers, Messrs Robert Sorby & Sons, fully maintained their wide reputation for the excellency of their goods, by the complete collection they exhibited of all the tools used in forestry, each perfect in quality and finish. The collection of strong, plain and serviceable tools and implements exhibited by Messrs Fleming and Co., of Glasgow, as well as their models of bridges, sheds, cottages, and especially their most complete set of tools adapted for forming every description of drain, were much admired by practical men.

The remarkable display of India-rubber goods, with the raw

material as abstracted from the trees in the tropical forests; and the exhibits of forest lodges, huts, and other erections of a cheap and temporary nature for forest operations, mostly constructed of wood, paper, or corrugated and galvanised iron, formed exceedingly instructive features in the Exhibition.

The extensive assortment of fencing and fencing materials in the grounds was a special centre of attraction to practical foresters, who anxiously scanned every improvement in this important branch of their profession.

Perhaps no other portion of the grounds was so much frequented by the general public as the machinery department, which was located at the farthest side of the field. Here was to be seen the newest wood-working and preparing machinery, a large portion of which was in motion, and generally surrounded by crowds of visitors admiring its various specialities and capabilities.

An important part of the programme, which merits special notice, were the conferences and lectures held during the Exhibition. Various matters of much importance to foresters and forestry were discussed by eminent men well skilled in the subject. Much interest was displayed in these gatherings, which it may be fairly hoped were the means of spreading useful information on this particular branch of knowledge.

To all arboriculturists, and to the Government of this country, the Exhibition taught many lessons. It afforded an opportunity, not often obtained, of comparing our progress with that of other countries, and showed us that from some of them we have still much to learn in connection with this important branch of national economy. That a fully equipped School of Forestry, for example, exists in Japan, and none in this country, is not much to the credit of Great Britain. It may be hoped, however, that this reproach will not long continue, and that in the science of Arboriculture we as a nation may, as we do in most other matters, lead, *not* follow!

The Scottish Arboricultural Society's Court.

In response to the intimation made to members by the Council of the Society, that an arrangement had been come to whereby any articles for exhibition which might be consigned to the Secretary would be taken care of and properly displayed in the Society's Court, about eighty members took advantage of the offer and

placed their exhibits in charge of the Council. These comprised a large and much varied assortment of valuable and useful articles, and specimens of the wood of every kind of forest tree grown in Britain, besides a host of miscellaneous exhibits of a rare or curious nature, which, together with the Society's own collections of books, plans, illustrations, instruments, tools, cones, seeds, wood specimens, and other articles, completely filled the Court, and made an effective and most interesting display.

At the entrance to the Court the Council had an office fitted up, in which the *Secretary* and his assistant attended to the Society's business during the whole time the Exhibition was open. This arrangement was found a great convenience to the members of the Society when visiting the Exhibition, as they could always get whatever information they required from Mr M'Laren, the *Secretary*, or his assistant, Mr Robert Forbes. To them was due the neatness, cleanness, and good order which prevailed in the Court, and their civility and readiness to give information about the exhibits in their charge was justly appreciated by exhibitors and visitors.

The following detailed list of the Collections exhibited in the Scottish Arboricultural Society's Court has been compiled by the Secretary from the official lists and other materials collected by him during the course of the Exhibition. The list is arranged in alphabetical order so as to make it useful as a reference :—

Scottish Arboricultural Society.

Set of Meteorological Instruments used at Carnwath. See Reports on Observations made at Carnwath, Lanarkshire, on the Influence of Forests on Climate, particularly Rainfall. Trans., Vol. VII., pt. iii., p. 285; and Vol. VIII., pt. ii., p. 168.

Collection of over 200 specimens of Woods, from Stevenstone Estate, North Devon.

Collection of 60 Woods, in a design suitable for a table, from Murthly Castle, Perthshire.

Sections of 42 Canadian Woods, presented by William Little, Montreal.

Collection of 65 longitudinal sections of Wood.

Album of 40 varieties of Wood, each cut in three different ways, from M. Wilmersdorffer, London.

Sections of 27 kinds of Woods in a stand.

Collection of 70 kinds of Seeds, in Boxes, from Stevenstone Estate, North Devon.

Collection of 34 varieties of Cones.

View of an Artistic Arbour at Hopetoun, Linlithgowshire.

List of Books Exhibited by the Society.

Arboretum et Fruticetum Britannicum. By J. C. Loudon, F.L.S. 8 vols., 1884.

Arboriculture. By John Grigor. 1 vol., 1868.

British Forest Trees. By P. J. Selby. 1 vol., 1842.

British School of Forestry. By J. C. Brown, LL.D. 1 vol., 1881.

Catalogue of the Forest Trees of North America. By C. S. Sargent. 1 vol., 1880.

Eichen Europa's und des Orient's. By Dr Theodore Kotschy. 1 vol., 1862.

Exotic Botany. By John Hill, M.D. 1 vol., 1772.

Forest Administration in the Madras Presidency. By D. Brandis, F.R.S., C.I.E. 1 vol., 1883.

Forest Administration in the North-West Provinces and Oudh. By D. Brandis, F.R.S., C.I.E. 1 vol., 1882.

Forest Administration in the Several Provinces under the Government of India. By D. Brandis, F.R.S., C.I.E. 1879 to 1882.

Forestry Bulletins of the United States. By C. S. Sargent. 1 vol., 1881.

Histoire des Chênes de l'Amerique Septentrionale. By Andre Michaux. 1 vol., 1801.

Indian Forest Department Code. 1 vol., 1881.

Management of the Leased Forests of Busáhir, Punjab. By D. Brandis, F.R.S., C.I.E. 1 vol.

Manual of Coniferæ. By James Veitch & Sons, Royal Exotic Nursery, Chelsea. 1 vol., 1881.

Manual of Indian Timbers. By J. S. Gamble, M.A., F.L.S. 1 vol., 1881.

Manual of Injurious Insects. By Miss E. A. Ormerod, F.M.S. 1 vol., 1881.

Manual of Jurisprudence for Forest Officers. By B. H. Baden-Powell. 1 vol., 1882.

Manual of Sylviculture. By G. Bagneris. 1 vol., 1876.

Manual of the Land Revenue System and Land Tenure of British India. By B. H. Baden-Powell. 1 vol., 1882.

Observations on Injurious Insects. By Miss E. A. Ormerod. 1880 to 1884.

Organisation and Valuation of Forests. By L. Macgregor. 1 vol., 1884.

Pinaceæ. By "Senilis." 1 vol., 1866.

Relatorio da Administração Geral das Matas. (Reports for 1879-80 of the Administration of the Forests of Portugal, with Maps.)

Report of the Central Board of Agriculture, Halifax, Nova Scotia. 1 vol., 1877.

Report of the Forest Board of South Australia. 1 vol., 1879-80.

Report of the Government Central Museum, Madras. 1 vol., 1880-81.

Report of a Visit to the English and Scottish Forests by the Professors and Students from the Forest School at Nancy, France. 1 vol., 1882.

Report of a Visit to the Torrent Regions of the Hautes and Basses Alps, and also to Mount Faron, Toulon. By E. M'A. Moir. 1 vol., 1880.

Report of the Smithsonian Institution, Washington, U.S.A. 1876 to 1883.

The Capercailzie in Scotland. By J. A. Harvie-Brown, F.Z.S. 10 vols., 1879.

The Cobham Journals. By Miss E. A. Ormerod, F.M.S. 1 vol., 1880.

The Forester. By James Brown. 1 vol., 1851.

The Larch Disease and Larch Plantations. By Charles M'Intosh. 1 vol., 1860.

The Pinetum Britannicum, *Complete*, of Messrs Lawson and Sons. 1884.

Transactions of Massachusetts Horticultural Society. 1880 to 1884.

Transactions of the Edinburgh Botanical Society. 1879 to 1883.

Transactions of the Scottish Arboricultural Society, *Complete.* 1855 to 1883.

Tree Culture in South Australia. By John E. Brown, F.L.S.

Woods and Forests of Perthshire. By Thomas Hunter. 1 vol., 1884.

Collection of Maps, Plans, Diagrams, and Illustrations of Forestal Subjects.

Gold Medal awarded to the Society.

Abercorn, His Grace the Duke of, per A. Dickson, Steward, Baron's Court, Co. Tyrone.

A set of fine cross-sections showing the rapid growth of forest trees in the North of Ireland, consisting of Larch, cubical contents of tree 134 ft., diameter of section 2 ft. 6 in., probable age 95 years; Silver Fir, diameter of section 3 ft. 4 in.; and Spruce, cubical contents of tree 161 ft., diameter of section 2 ft. 6 in., probable age 80 years.

Longitudinal section of a fine large specimen of Bog Oak found 10 ft. below the surface at Baron's Court.

Diploma awarded for the Collection.

Argyll, His Grace the Duke of, Inveraray Castle, Argyllshire.

A set of very fine cross-sections of the timber of the following trees:—

Beech, section 3 ft. 4 in. in diameter; tree contains 240 cubic ft.; height, 90; altitude, 40; aspect, east.

Silver Fir, section 4 ft. 2 in. in diameter; tree contains 500 cubic ft.; height, 120; altitude, 100; aspect, south.

Scots Fir, section 2 ft. 9 in. in diameter; tree contains 216 cubic ft.; height, 90; altitude, 40; aspect, south-east.

Yew, section 3 ft. 3 in. in diameter; tree contains 75 cubic ft.; height, 45; altitude, 60; aspect, east. An extraordinary fine specimen.

Silver Medal awarded for the Collection.

Ahlbottn, Nathaniel, 50 Shore, Leith.

A New Transplanting Machine. *Bronze Medal awarded for the Invention.*

A collection of young Trees, growing in tubs, showing application of the Exhibitor's Composition for protecting trees from the ravages of hares, rabbits, and stock.

Barclay, David, Forester, Sorn Castle, Ayrshire.

A Folding Rustic Table.

Baxter, Robert, Forester to His Grace the Duke of Buccleuch, Dalkeith Park, Midlothian.

Collection of over 100 Wood Sections grown on the Dalkeith Estate.

Four large specimens of Oak Veneers from the Old Caledonian Forest in Dalkeith Park, showing extra fine quality and beautiful curl.

Rustic Picture Frame, the property of Mrs W. Stewart, Dalkeith.

A fine collection of Forest Tree Leaves, neatly arranged in frames, mounted on revolving stand, and preserved so as to show the natural rich autumn tints.

Silver Medal awarded for the Collection.

Brotherston, A., Kelso, Roxburghshire.

An extensive Collection of Dried Specimens of Home and Foreign Willows.

Silver Medal awarded for the Collection.

Brown, John A. Harvie, of Quarter, Dunipace, Stirlingshire.

Photographic Album of Notable Trees on his Estates in Stirlingshire.

Commended.

Brown, Mrs Harvie, Dunipace House, Larbert, Stirlingshire.

A Richly Inlaid Work-box of Sandal-wood, and another of Kyaboka-wood, both fine specimens of Indian Workmanship.

Commended.

Brow, William, The Gardens, Kilmaron Castle, Fifeshire.

Cones of *Picea nobilis*, from a tree grafted on a Silver Fir in 1861, and 45 feet high in 1884, has thrice lost its leader.

Cones of *Picea nobilis*, from a tree raised from seed at Kilmaron in 1866, and now 25 feet high.

Branch of a *Wellingtonia*, showing a heavy crop of ripe and unripe cones on the same branch.

Bruce, Thomas Rae, of Slogarie, Kirkcudbrightshire.

Stevenson's Anemometer, accompanied by a scale showing force of wind in recent storms.

Photographs of two trees of *Wellingtonia Gigantea*, called "The Two Sentinels;" and the "Half Dome," 1500 feet high, in the Yosemite Valley, California; and an avenue of *Cryptomeria Japonica*, in Japan.

Buccleuch, His Grace the Duke of, K.T., per Wm. Doughty, Forester, Canonbie, Dumfriesshire.

PHOTOGRAPHS OF REPRESENTATIVE TREES GROWING ON THE ESKDALE ESTATE.

NAME OF TREE.	Site and Age.	Soil.	Altitude.	Height of Tree.	Contents.
No. 1. OAK, "The Duke," . . .	Sloping bank, sheltered.	Thin loam, on gravelly subsoil.	320 ft.	60 ft.	232 cub. ft.
No. 2. OAK, "The Duchess," . .	Same as above.	Same as above.	320 ft.	60 ft.	188 cub. ft.
No. 3. Four OAKS growing on one root, having quarter girt at the ground of 57¼ in., . .	Open woodland, sheltered	Same as above.	200 ft.	56 ft.	No. 1, 69 ; ,, 2, 81 ; ,, 3, 62 ; ,, 4, 105: Total, 317 cub. ft.
No. 4. OAK near Irvine House, . .	Low and sheltered.	Loam, on gravelly subsoil.	180 ft.	60 ft.	318 cub. ft.
No. 1. ASH at Forge,	Low and sheltered, growing by the side of an old mill-race.	Loam, on New Red Sandstone.	110 ft.	60 ft.	235 cub. ft.
No. 2. ASH at Forge,	Low and sheltered.	Loam, on gravel, and New Red Sandstone.	110 ft.	60 ft.	302 cub. ft.
No. 1. SYCAMORE at Hagg-on-Esk (a favourite tree of the late Duke of Buccleuch),	At the bottom of a sloping bank.	Loam, on gravel.	200 ft.	90 ft.	803 cub. ft.
No. 2. SYCAMORE at Skipper's Bridge. This tree was much broken by the storm of 14th Oct. 1881, but is now rapidly recovering its form,	Growing on the banks of the Esk, by the edge of the Trap Dyke formation.	Thin loam, on gravel.	230 ft.	70 ft.	233 cub. ft.
No. 3. SYCAMORE at Gilnockie Cottage,	Open woodland.	Sandy loam.	170 ft.	60 ft.	449 cub. ft.
No. 1. LARCH in Hollow-well Boggs Plantation (made 1¾ cub. ft. of timber per year), . .	At the bottom of a bank and sheltered. Age 140 years.	Gravelly loam, on New Red Sandstone.	140 ft.	100 ft.	222 cub. ft.
No. 2. LARCH (made 2 cub. ft. of timber per year), . .	Same as above. Age 140 years.	Same as above.	140 ft.	100 ft.	280 cub. ft.
No. 3. LARCH, Auchinrivock Bank (made rather more than 1¾ cub. ft. of timber per year), .	Same as above. Age 140 years.	Gravelly loam.	200 ft.	100 ft.	196 cub. ft.

Name of Tree.	Site and Age.	Soil.	Altitude.	Height of Tree.	Contents.
No. 1. Scots Fir (made $\frac{4}{6}$ cub. ft. of timber per year), .	Growing on a sloping bank.	Thin loam, on gravel.	200 ft.	80 ft.	112 cub. ft.
No. 2. Scots Fir (made 1 cub. ft. of timber per year), .	Same as above.	Same as above.	200 ft.	80 ft.	140 cub. ft.
No. 1. Silver Fir (made $4\frac{2}{3}$ cub. ft. of timber per year), .	On the banks of the Esk. Age about 140 years.	Black loam, moist bottom.	180 ft.	112 ft.	672 cub. ft.
No. 2. Silver Fir (made 4 cub. ft. of timber per year), .	Same as above. Age about 140 years.	Same as above.	180 ft.	112 ft.	563 cub. ft.
No. 3. Silver Fir (rather more than 2 cub. ft. of timber per year), . .	Same as above. Age about 140 years.	Same as above.	180 ft.	112 ft.	314 cub. ft.
No. 1. Spruce in Deanbanks (made 2 cub. ft. of timber per year), . .	At the bottom of a steep bank. Age 140 years.	Thin loam, on gravel.	180 ft.	124 ft.	280 cub. ft.
No. 2. Spruce (made $1\frac{1}{4}$ cub. ft. of timber per year), . .	Same as above. Age 140 years.	Same as above.	180 ft.	124 ft.	180 cub. ft.
Abies Douglasii (made 1 cub. ft. of timber per year), .	Low and sheltered. Age 30 years.	Loam, on gravel.	180 ft.	45 ft.	30 cub. ft.

A Set of Large and Fine Sections of Trees grown on the Buccleuch Estate in Eskdale.

Six Sections of flowered or mottled Oak, showing a very fine curl for veneers.

One Section of Oriental Plane, showing fine curled grain.

Two Sections (length and cross) of Larch Timber. Circumference, $9\frac{1}{2}$ ft.; diameter, 3 ft. $0\frac{1}{2}$ in.; length, $4\frac{1}{2}$ ft.; breadth, $2\frac{1}{2}$ ft.; thickness, 2 in.

Two Sections (length and cross) of Scots Fir Timber. Circumference, 9 ft.; diameter, 3 ft.; length, $4\frac{1}{2}$ ft.; breadth, 2 ft. 9 in.; thickness, 2 in.

Two Sections (length and cross) of Spruce Fir Timber. Circumference, 8 ft. Diameter, 2 ft. $7\frac{3}{4}$ in.; length, $4\frac{1}{2}$ ft.; breadth, $2\frac{1}{2}$ ft.; thickness, 2 in. These sections of Spruce Fir show in a remarkable degree the effects of severe thinning about 60 years ago.

Two Sections (length and cross) of Silver Fir Timber. Circumference, $12\frac{1}{2}$ ft.; diameter, 4 ft.; length, $3\frac{1}{2}$ ft.; breadth, 17 in.

One Field or Plantation Gate, made on the estate, of Larch timber.

The following Exhibits were from the Duke of Buccleuch's Estate of Eildon Hall, Roxburghshire :

One Field or Plantation Gate.
One Scots Fir Railway Sleeper.
One Silver Fir Railway Sleeper.
One Spruce Fir Railway Sleeper.
Two Sections (length and cross) of Scots Fir.
Two Sections (length and cross) of Silver Fir.
Two Sections (length and cross) of Spruce Fir.

Silver Medal awarded for the Collection.

Christie, Alex. D., The Gardens, Warwick Castle, Warwickshire.

A section of Cedar of Lebanon from a tree grown at Warwick Castle, showing the ravages of the Giant Sirex (*Sirex gigas*). with the insects at work.

Awarded a Certificate.

Clark, John, Forester, Kelly, Wemyss Bay, Renfrewshire.

Dendrometer; invented by the Exhibitor.

Colquhoun, Andrew, Forester, Rossdhu, Luss, Dumbartonshire.

A very fine set of cross sections of timber of the following trees:—Larch, 3 ft. 2 in. in diameter; Oak, 2 ft. 10 in. in diameter; Scots Fir, 2 ft. 4 in. in diameter; Silver Fir, 4 ft. 6 in. in diameter; Spruce Fir, 1 ft. 9 in. in diameter; Sycamore, 1 ft. 10 in. in diameter; and Yew, 2 ft. 4 in. in diameter.

Bronze Medal awarded for the Collection.

Coupar, Robert, Forester, Ashford, County Galway, Ireland.

Four sheets of Diagrams, and numerous interesting specimens, illustrating the Larch Disease, known as "Blister," and Natural Engrafting.

Commended.

Cowan, Charles W., Valleyfield, Penicuik.

Curiously contorted root which grew in shingle on the banks of the river Lyon, Perthshire.

Cumming, Sir William G. Gordon, Bart., of Altyre, Morayshire.

Length Sections of Scots Fir and Larch.
Six Cones of *Picea nobilis.*
One Plank of Bog Oak.
Two Larch Trees, naturally grafted or inarched on each other.
Natural Engrafted Larch.

Curious Scots Fir Top.
Rustic cut of a Gean Tree.

Diploma awarded for the Collection.

De Eresby, The Right Honourable The Baroness Willoughby, Drummond Castle, Perthshire.

A grand cross-section of Silver Fir from a tree about 200 years old, girthing 18 ft. 7 in. one foot up, and 15 ft. 6 in. at five feet up. Cross and length sections of *Cedrus Atlantica*. Sections of Boxwood. All grown at Drummond Castle.

Set of Tools, including—Dendrometer, Felling Axe, Snedding Axe, Two-handed Hedge-bill, Single-handed reversible Hedge-bill. All new and neatly finished; made at Drummond Castle.

Certificate awarded for the Collection.

Dickson, Professor Alex., M.D., of Hartree, *Regius Keeper* of the Royal Botanic Garden, Edinburgh.

Specimen of the Transverse Section of the Stem of a Fossil Tree from Craigleith Quarries, near Edinburgh.
Stems of Ivy curiously interwoven on an iron railing.
Paddlewood Tree (*Aspidosperma excelsa*) from Guiana.
Stem of Tree Fern (*Dicksonia antartica*).
Interesting collections of Forest and Botanical specimens and curiosities.

Special Diploma awarded for the Collection.

Dicksons & Co., Nurserymen, 1 Waterloo Place, Edinburgh.

Palms and Himalayan Rhododendrons, growing in tubs.

Dickson, James, & Sons, Nurserymen, Hanover Street, Edinburgh.

A fine general collection of Coniferæ and other Ornamental Trees and Shrubs.

Duff, James, Steward, Freeland, Bridge of Earn, Perthshire.

A splendid Plank of Cedar of Lebanon, 10 ft. long by 2 ft. 5 in. wide, grown at Freeland.

Highly Commended.

Dunn, Malcolm, The Palace Gardens, Dalkeith, Midlothian.

A case containing specimens of the Capercailzie, cock and hen; Muircock and Muirhen, or "Black Game;" and other "Enemies of the Forest;" and Curiosities from the forests of South Africa.

Fechney Industrial School, The, Perth.

A Miscellaneous Collection of Useful Articles, chiefly turned wood goods, comprising—Spinning-wheel, Two Tables, Set of Kitchen Articles, Spiral Columns, Table and Chair Legs, Stair Balusters, Hammer Handles, and Thread Spools, in all the different stages of manufacture, made from Birch grown on Bonskeid Estate, Perthshire.

Certificate awarded for the Collection.

Fergusson, Miss Gillon, 31 Chester Street, Edinburgh.

A Water-bottle from Patras; and a Model of a Norwegian Travelling Box.

A Palm-Leaf Broom from Gibraltar. Sugar-Cane grown at Motril, Spain.

Fir-Tree "Flannel" from Thüringen Forests, Germany.

Specimen of Cloth made from the Bread-Fruit Tree by the Natives of the Marquesas Islands.

Maori Chief's Mat made from New Zealand flax (*Phormium tenax*), with Kaw-Kaw Feathers.

Commended.

Finlayson, Matthew, 23 Castle Street, Edinburgh.

A Tub made from the stem of a Palm Tree.

An Elm Burr cut on Amisfield Estate, Haddingtonshire.

Forbes, William, Forester, Stoneleigh Abbey, Warwickshire.

Dendrometer; invented by the Exhibitor.

Forgan, James, Overseer, Bonskeid, Perthshire.

Large Specimens of Fungi found growing on decaying Birch at Bonskeid.

Forsythe, John M., Wood Manager, Gowran Castle, Kilkenny.

Fifty dressed Sections of Woods grown on the Gowran Estate.

Diploma awarded for the Collection.

Green, A. A., Edinburgh.

A Bamboo Alpine-Stock, and a Nepaulese Chookrie.

Haddington, the Earl of, per Thomas Wilkie, Wood Manager, Tyninghame, East Lothian.

Forty-five kinds of Wood suitable for turning, including various kinds of Cedar, Cypress, Maple, *Prunus*, *Pyrus*, and Thorns; Alder, Arbutus, Ash, Barberry, Beech, Birch, Box, Broom, Elder, Elm, Hazel, Holly, Hornbeam, Labur-

num, Lime, Locust, Oak, Rhododendron, Sloe, Sweet Bay, Tulip, Walnut, Whin, Yew, and other woods.
Collection of 174 sections of Wood.
Coniferous Tree Fossil, rough and polished.
Dried Tree Leaves.
Elm Burr.
An interesting set of Wood Sections, showing benefits of pruning trees and evils of neglecting to prune.
A large collection of Abnormal Tree Growths and Excrescences.

Silver Medal awarded for the Collection.

Hamilton, Robert, 29 St James Square, Edinburgh.
Thomson's Fluid Enamel for Preserving Woodwork, Stonework, Pictures, etc. *Awarded a Diploma.*
Several Fine Samples of Resins.
Models of Nobel's Explosives, such as are used for blasting tree stumps. *Awarded a Diploma.*

Horsburgh, James, Forester, Yester, Haddingtonshire.
Specimens of Knots or Burrs of Alder, with Carvings of heads and faces.

Hunter, Dr, 18 Belgrave Crescent, Edinburgh.
A curious Scottish Thorn Walking-stick, with a Bronze Miniature Head of a Staghound.
An Irish Black Thorn Walking-stick or "Shillelagh."

Hunter, William, Forester, Drummond Castle, Perthshire.
Oil Painting, View of Torlum Hill.
Oil Painting, Silver Fir in Drummond Park.
Oil Painting, an Oak.
Rustic Table for Arbour; all the work of the Exhibitor.

Commended.

Hutchison, Robert, of Carlowrie, Kirkliston, Linlithgowshire.
An extensive Collection of excellent Photographs of rare and remarkable British trees.

Jackson, Magnus, *Photographer* to the Scottish Arboricultural Society, Perth.
A remarkably large and fine collection of Photographs of

Remarkable Trees and other Forest subjects in Scotland, mounted in frames, in albums, and on cards.

A fine section of one of the Original Larches planted at Monzie in 1738.

Oak Root found near Perth beneath a seam of clay 14 ft. thick.

Portion of an ancient Canoe found beneath a bed of clay 12 ft. thick and 30 ft. above the present level of the river Tay at Perth.

Silver Medal awarded for the Collection.

Jeffrey, John, of Balsusney, Kirkcaldy, Fifeshire.

"The Trees and Shrubs of Fife and Kinross," in a beautifully illustrated volume.

Awarded a Diploma.

Johnston, William, Forester, Munches, Dalbeattie, Kirkcudbrightshire.

Dendrometer; invented by the Exhibitor.

Wire Strainer; invented by the Exhibitor.

Kay, James, Wood Manager, Bute Estate, Rothesay.

Dendrometer.

Wire Straining Pillar.

Model of Transplanting Machine.

All invented by the Exhibitor.

Lothian, The Marquess of, K.T., Newbattle Abbey, Midlothian.

Two beautiful Carved Oak Panels, from wood grown in Newbattle Park; the carving being done in the Estate Carpenter's Workshop.

Three Inlaid Tables, showing neat and tasteful workmanship —two of them made in the Estate Carpenter's Workshop, from wood grown in the Park at Newbattle Abbey. The inlaid curves of the other are made of the natural growth of a Pear Tree, which grew at Newbattle Abbey.

A Collection of Fossils from Newbattle Abbey, found on the Estate.

Low, Joseph, Forester, Rothes Estate, Leslie, Fife.

Model of River Embankment, showing two different methods of preventing erosion; designed by the Exhibitor.

A Rustic Flower Stand, Table, and Four Stools.

Model of Rustic Bridge.
Pair of Rustic Picture Frames.
Two Curiosities of growth in trees.
Bronze Medal awarded for the Collection.

M'Corquodale, William, Forester and Wood Surveyor, Jeanie Bank, Scone, Perth.

Model of a useful wooden Bridge erected over the river Almond, at Lynedoch, Perthshire, 34 years ago, which is still serviceable. Designed by the Exhibitor.

A Post of Douglas Fir (*Abies Douglasii*) which was used in a wire fence for seven years and four months, and is still sound.

Larch Wire Fence Post which had been preserved with concrete at the surface of the ground.

Collection of 24 Specimens of Timber grown on the Scone Estates, and cut into boarding as used for Estate purposes; including *Abies Douglasii*, *Picea nobilis*, *Pinus cembra*, *P. excelsa*, *P. strobus*, and *P. laricio;* Ash, Black Italian Poplar, Cherry, Elm, Larch, Laburnum, Norway Spruce, Scots Fir, and Sycamore.

A Silver Fir (*Picea pectinata*) Railway Sleeper, which was in use on the Caledonian Railway at Luncarty, near Scone, over 7 years, and is still sound; while Baltic Timber Sleepers, laid at the same time, were worn out at the end of 6 years.

Four Sections of Larch and Spruce, illustrating *sound* and *unsound* timber, with Samples of the Soil which produces the *sound* and *unsound* Larch and Spruce respectively.

Rustic Picture Frame.

A Larch Stool or Stump, showing how it was nourished underground by a naturally engrafted root, for sixteen years after the tree was cut.

Two Field Gates: one made from *Abies Douglasii* and the other from *Picea nobilis*, showing how suitable the wood of these trees is for such purposes.

Model of Revolving "Smoking" Arbour, made of wood and heather, erected at Logiealmond Shooting Lodge, Perthshire; designed by the Exhibitor.

Silver Medal awarded for the Collection.

M'Gregor, Duncan, Forester, Camperdown, Forfarshire.

A 3-inch Plank of *Picea nobilis*, 5 ft. long by 18 in. wide, grown at Camperdown.

Commended.

Mackenzie, Sir Alexander Muir, Bart., of Delvine, Dunkeld.

Sections of the Woods of *Arbor-vitæ*, *Eucalyptus*, Cedar, and Ivy, from Algeria.

Cork and Acacia Barks from Algeria.

Alfa Grass from Algeria.

Eucalyptus leaves from Algeria.

Silver Medal awarded for the Collection.

Mackenzie, D. F., Estate Office, Morton Hall, Edinburgh.

One Range-Finder; invented by the Exhibitor.

Three Dendrometers; invented by the Exhibitor.

Silver Medal awarded for the New Dendrometer.

Collection of 117 Woods grown in Scotland, in a design forming the top of a Library Table, composed of nearly 10,000 pieces, all solid, and finished in their natural colour.

Bronze Medal awarded for Table and Woods.

Capercailzie Cock and Hen.

M'Laren, John, Forester to the Earl of Hopetoun, Hopetoun, Linlithgowshire.

Set of Tools used in Forestry:—Cross-cut Saw. Long-handled Pruning Saw. Wood Cleaver. Felling Axe. Three Hedge-bills. Two Hand-bills and Pruning Saw, showing method of carrying tools while pruning, by the use of belt and satchel. These tools have all done good service, and are fair samples of those in ordinary use in the Hopetoun Woods.

One hundred and fifteen sections of different Woods.

Section showing the union of *Abies morinda* grafted on the Norway Spruce.

Eighteen Longitudinal Wood sections.

Cross-sections of *Wellingtonia gigantea*, 1 ft. 6 in. in diameter; Silver Fir, 4 ft. 4 in. in diameter; and Spanish Chestnut, 3 ft. 10 in. in diameter—all grown at Hopetoun.

Section of a Fossil Tree 28 feet long, found in a freestone quarry at Hopetoun.

A Collection of Conifers, including—*Cupressus Lawsoniana* and *Thuiopsis dolabrata*, grown from cuttings; Scots Fir, showing the difference between plants raised from foreign and home-grown seed; two plants of *Cedrus Libani* raised from seed collected in the Lebanon by the Countess of Hopetoun in 1865; *Pinus pyrenaica* grafted upon *Pinus sylvestris;* and the true type of *Cedrus deodara.*

A specimen of Norway Spruce (*Abies excelsa*), blown over about forty years ago, thereafter rooting in two places along the prostrate bole of the tree, from which two trees have grown up, one to the height of 63 feet 5 inches, the other 61 feet 4 inches.

A curious excrescence of an Elm (*Ulmus montana*).

Silver Medal awarded for the Collection.

Maxtone, Robert, Forester, Strathallan Castle, Perthshire.

Harmonium made by Exhibitor from wood grown on Strathallan Estate. *Awarded a Diploma.*

A Staple Drawer; invented by the Exhibitor.

Self-Shutting Iron Wicket gate; invented by the Exhibitor.

Cross and length sections of the following woods:—*Cedrus Libani*, about ninety years old. Blown down on 27th January 1884. Height, 63½ ft.; girth at 3 ft. up, 12½ ft.

Abies Douglasii. Planted in 1866. Blown down on 28th December 1879 (Tay Bridge gale).

Abies Douglasii. Planted in 1866; a fine specimen, showing very rapid growth.

Picea pinsapo, about thirty years old.

Cross and length sections of Bog Oak, 23 ft. long and 4½ ft. broad at the root end; found in a moss at the Muir of Tullibardine.

Cross section of Norway Spruce.

Length section of a fine and very old Holly Tree, blown down 28th December 1879; formerly used as a target. The section shows an arrow-head and arrow points sticking in it.

Six live plants of *Abies Douglasii* raised from seed sown in 1880; gathered from trees grown at Strathallan Castle, the seed of which was grown at Murthly Castle, the young trees exhibited being the *Third Generation* of the Douglas Fir grown in Perthshire.

Bronze Medal awarded for the Collection.

Methven, John, Nurseryman, 15 Princes Street, Edinburgh.
Tonquin Beans, from Virtue & Co., Chemists, Georgetown, Demerara.

Michie, John, Forester, Balmoral, Ballater, Aberdeenshire.
Cross and length sections of Scots Fir from Ballochbuie Forest. The length section shows heartwood 2 ft. 11 in. wide.
Live specimens of the Pine Weevil (*Hylobius abietis*).
Collection of Dried Native Mosses, mounted in an album.

Mitchell, James, Aldie Castle, Kinross.
A curious section of Oriental Plane over 300 years old.

Oliver, Geo., Royal Botanic Garden, Edinburgh.
A fine Collection of British Insects injurious to forest trees and other plants.
Bronze Medal awarded for the Collection.

Paterson, Smith, & Innes, 77 South Bridge, Edinburgh.
An elegant suite of Bedroom Furniture.
Commended.

Rae, J. S., Forester, Dunipace House, Larbert, Stirlingshire.
Four Cases of Dried Leaves collected in Scotland by the Exhibitor.
Stem of *Cupressus Lawsoniana*, with a curious bulbous growth near the root.
Model of Bridge, 20 ft. long by 4½ ft. wide, which can be erected by two men in a day at a cost of less than £1.
Bronze Medal awarded for the Collection.

Ravenscroft, Edward, 14 London Road, St John's Wood, London.
Thirty-eight of the original Coloured Illustrations for Lawson's "Pinetum Britannicum."

Richardson, A. D., Royal Botanic Garden, Edinburgh.
A Highly Interesting Collection of 72 Microscopic Sections, illustrating the structure of the Stems, Roots, Leaves, etc., of Trees and Shrubs.
Silver Medal awarded for the Collection.

Rider, William H., "Forestry" Office, 14 Bartholomew Close, London, E.C.
The "Journal of Forestry," *complete.*
Collection of Works on Forestry.

Thomas J. Syer's Standard Instantaneous Grip-Vice, and Bench Knife.

Diploma awarded for the Collection.

Robertson, James, Forester, Panmure, Carnoustie, Forfarshire.

Collection of Timber Specimens in frame.

A Longitudinal Section of a very fine old Larch Tree, showing heartwood 22 inches wide.

Six Small Model Baskets, made of Willows.

Inlaid Portable Writing Desk, composed of upwards of 2700 pieces of 22 varieties of wood.

Rustic Elm Chair for Garden or Forest.

Bronze Medal awarded for the Collection.

Robertson, John, Forester, Minto, Hawick, Roxburghshire.

A curious piece of wood naturally grown and shaped like a hand.

Romanes, Mrs, Meadowbank, Eskbank, Midlothian.

Work-box made from "Queen Mary's Tree," a Plane (*Acer pseudo-platanus*) said to be planted by her at Little France, near Craigmillar Castle, Midlothian, about the year 1561; with Shield designed by Mrs D. O. Hill.

Commended.

Sandeman, Mrs, 12 Royal Crescent, Edinburgh.

American Boxwood Fretwork.

Smith, James, Overseer, Moredun, Edinburgh.

Large old Vine Stem, supposed to be over 130 years old.

Commended.

Smith, Thomas, Nurseryman, Stranraer, Wigtownshire.

Collection of Conifers.

Collection of Hybrid and other Roses.

Smith, William, Chemist, Deanhaugh Street, Edinburgh.

A Case of Insecticide for the destruction of vermin on trees, shrubs, etc.

Awarded a Diploma.

Stuart, Dr Moody, Edinburgh.

Nine sections of Wood grown by the late William Gorrie at Annat, Errol, Perthshire, with particulars of age, several showing very free growth.

Diploma awarded for the Collection.

Strathallan, The Right Honourable the Viscount, Strathallan Castle, Perthshire.

A case containing the head of a Roe Deer, mounted on black Bog Oak, both of which were found in the Moss of Tullibardine.

A fine specimen of a Walking-Stick made of Whin (Gorse).

Sutherland, Evan C., of Skibo, Sutherlandshire.

A very interesting Collection of useful Forest products, including Specimens of twenty-six varieties of Wood grown at Skibo.

Three Larch and five Scots Fir Railway Sleepers.

Six Beech Cubes of Wood Paving.

Six Scots Fir Staves.

Five Scots Fir and two Spruce Boards for making Boxes.

Specimens of "Crown" and "Common" Props.

Specimens of natural-grown Silver Fir, Larch, and Spruce.

Specimens of Bog Oak and Bog Fir.

Collection of Fir Cones.

Bronze Medal awarded for the Collection.

Sutherland, His Grace the Duke of, per William Baxter, Forester, Dunrobin Castle, Sutherland.

Sections of Oak, Ash, Elm, Plane, Beech, and Birch, showing what the Exhibitor (W. B.), after long experience, has almost invariably found, that the close cutting off of a contending leader, which, as a rule, proceeds from the tree at an angle of 45 degrees, seldom fails to cause ruinous effects.

Specimens of Hardwood, showing injury done by Red and Roe Deer; also specimens showing method of protecting young trees from the ravages of Deer.

Small Larch Stem which was cut over fourteen years ago, and has continued alive without foliage, producing the coalescence shown.

Specimens of Calcareous Incrustation on Mosses from dripping rock, Golspie Burn.

Curious structure from Dunrobin Museum, simulating a shell, found in the interior of a Scots Fir 2 ft. in diameter.

A plant of a white-leaved variety of Horse-Chestnut, growing in a tub.

Diploma awarded for the Collection.

Sutherland, His Grace the Duke of, per D. M'Corquodale, Forester, Dunrobin, Sutherlandshire.

Two length sections of Scots Fir, 151 years old. The tree had a straight clean bole of 30 ft., and contained 80 cubic ft. of saleable timber.

Piece of Small Rope made by hand from Bog Fir Root Fibre, such as was made and used by the natives of Sutherland many years ago.

Piece of Baltic Redwood Flooring that was laid on the top of garden mould, and became decayed in four years.

A piece of a Standard in a Partition which became decayed in six years owing to its having rested on damp soil.

The end of a Rafter of Strathspey Fir Wood which stood on a dry and airy wall for 100 years, and is still sound, showing that to preserve timber in buildings the best method is to protect it from damp, and give plenty air around it.

The lower end of a pile which stood at the outer end of Dunrobin Sea Low-water Jetty, showing the destruction done by *Lemonoria terebrand*, or *perforata*, in eight years.

Fossil Plants of Coal Measures. Cycadaceous Plant, 2 sections with polished faces, from Upper Oolite formation. A section of the same not polished, with a cross section of 17 × 8 inches. Zamites from Middle Oolite, Brora, Sutherland. A Fossil Fern from Upper Oolite, Helmsdale. A Coniferous Tree Fossil from Upper Oolite, Helmsdale. *Aracaritus* from Middle Oolite, Brora.

Section base of stem of Bog Fir, showing 380 concentric rings, found at Shiness, situated about 400 ft. above sea-level.

Root Cut of Bog Fir, showing 350 concentric rings, found at Tongue, Sutherland, 100 ft. above the sea-level.

Photograph of vertical section of Peat Bog, containing several horizontal layers of Scots Fir Roots, the one above the other.

A set of Photographs of Hardwood Trees, illustrating those requiring pruning, and the same trees after being pruned.

A collection of sections of Wood, with Photographs illustrating the effects of good and bad pruning, and sections showing the bad effect of contending leaders when growing close together.

A collection of Natural Grafts and curious Excrescences of trees.

Specimens of dwarfed and contorted Scots Fir from a high altitude.

Bronze Medal awarded for the Collection.

Sutherland, His Grace the Duke of, per J. B. Kidd, Forester, Dornoch, Sutherlandshire.

Photograph of a very fine Gean Tree growing at Sidera, Dornoch.

Cross section of a fine old Holly Tree, the trunk of which contained 43 cubic feet of timber.

An eight feet length of the same tree, showing a defective side, the result of close pruning.

Length section of the top of the same, showing where a limb had been pruned.

An instructive sample of the Tops of Scots Fir Trees, from about 6 inches to 1 inch in diameter, showing the great damage done by squirrels biting the bark off them.

Diploma awarded for the Collection.

Thomson, B. Lumsden, of Thomson & Company, Derby, and 85 Gracechurch Street, London.

A Special Model of Forester's House built of Thomson and Company's Vitrified Iron, which was awarded the Medal at the recent Calcutta Exhibition, not only for its durability, but also for keeping the interior of buildings cool.

Tindall, James, The Gardens, Sprotborough Hall, Yorkshire.

Two Photographs of a grand Wych Elm growing in the grounds at Sprotborough Hall. Circumference of branches 438 ft.; girth of bole, 4 ft. up, 18 ft.; at 6 ft. up, 19 ft. 6 in.: height of stem to spring of branches, 15 ft.; height of tree, 85 ft.; about 180 years old. Site moderately sheltered; altitude, about 250 ft.; aspect, south; soil, strong marly loam, resting on magnesian limestone. Tree in vigorous health, making annual growths 12 to 18 in. long. Frames made of Evergreen Oak (*Quercus ilex*), showing a richly marbled grain.

Trotter, Colonel, of Morton Hall, Midlothian.

A splendid specimen of Elm Burr, and a cross section of same.

Highly commended.

Tweeddale, the Marquis of, Yester, Haddingtonshire.

A Beautiful Model of a Temple and several Figures, all made by the natives of India, of the white ivory-like Pith of an Indian wood.

Bronze Medal awarded for the Collection.

Watson, John, The Gardens, Stravithie, St Andrews, Fifeshire.
An Ornamental Rustic Wicket Gate.

Webster, A. D., Forester, Penrhyn Castle, North Wales.
Two Slate Tree Labels.
Specimen of Slate Fencing.
Thirty-six sections of new and rare *Coniferæ* grown at Penrhyn Castle, many showing great freedom of growth.
Collection of Cones of the rarer Conifers grown at Penrhyn Castle.
Forty mounted specimens of the Ferns of Carnarvonshire, as illustrative of "Forest Flora."
Bronze Medal awarded for the Collection.

Webster John, Gardener and Forester, Gordon Castle, Morayshire.
An interesting Collection of Forest Specimens, comprising:
Natural Root-engrafting of the Larch.
Taxodium sempervirens, with curious bulbous growth at the root.
Mistletoe, showing root-growth.
Ivy Stems, showing 36 natural grafts.
Burr Knot on Fir Branch.
Commended.

Wyton, William, The Gardens, Heysham Hall, Lancaster.
A Drawing-room Photograph Stand or Album, composed of 580 pieces of Wood, carved with a pocket-knife, and put together without nails, in the form of a Gothic pyramid.
Awarded a Diploma.

Exhibits by Members of the Scottish Arboricultural Society outside of the Society's Court.

Her Majesty The Queen, Balmoral Castle, Aberdeenshire.
A Rustic Chalet or Summer House wholly constructed of Scots Fir; several grand specimens and sections of Scots Fir Wood; and sections of the ground on Deeside, showing the nature of the soil in which the Scots Fir thrives.
Gold Medal awarded for the Collection.

Athole, His Grace the Duke of, K.T., Blair Castle, Blair Athole, per J. M'Gregor, Forester, Ladywell, Dunkeld, Perthshire.
A highly instructive series of Larch sections, etc., illustrating the various stages of the "larch disease," dry-rot, and blister.
A Field Gate made of Larch Wood.
Silver Medal awarded for the Collection.

Austin & M'Aslan, Nurserymen, Glasgow.
Collection of Hardy Conifers and other Trees and Shrubs.
Bronze Medal awarded for the Collection.

Bain, William, & Co., Lochrin Ironworks, Edinburgh.
Collection of various designs of Plain and Ornamental Gates, and Iron and Wire Fencing.
Diploma awarded for the Collection.

Barbour, George F., of Bonskeid, Pitlochrie, Perthshire.
Large Section of Ash from Glen of Fincastle.
Awarded a Diploma.

Barrie, James, Forester, Stevenstone, Devonshire.
Numerous and excellent collections of Woods, Seeds, Cones, etc., from the Stevenstone Estate.
Silver Medal awarded for the Collection.

Brandis, Dietrich, Ph.D., Bonn, Germany.
Forest Flora of India, Forest Reports, etc.
Silver Medal awarded for the Collection.

Brown, John E., Conservator of Forests, Adelaide, South Australia.
Treatises and Reports on the Forests and Forest Flora of South Australia. *Silver Medal.*
Australian Trees and Forest Illustrations. *Diploma.*

Cleghorn, Hugh, M.D., of Stravithie, St Andrews, Fife.
A series of interesting and curious Forest Articles; specimens of damage done to wood by Insects; Illustrations of Forest Scenery, etc.

Dickson & Sons, James, Newton Nurseries, Chester.
An extensive and varied collection of Ornamental Conifers and other Trees and Shrubs. *Gold Medal.*
Collections of Tools, Seeds, Cones, etc. *Bronze Medal.*

Elliot, Sir Walter, K.C.S.I., Wolfelee, Roxburghshire.
Fine collection of Carved Woodwork from India.
Diploma awarded for the Collection.

Hartland, Richard, The Lough Nurseries, Cork.
Two cases of Cones, sections of Irish Woods, etc.
Diploma awarded for the Collection.

Ireland & Thomson, Nurserymen, Edinburgh.
A choice collection of Ornamental Conifers and other Trees and Shrubs.
Silver Medal awarded for the Collection.

Laird & Sons, R. B., Nurserymen, Edinburgh.
A collection of Ornamental Plants and Shrubs.
Diploma awarded for the Collection.

Lamont & Son, John, The Glen Nurseries, Musselburgh.
A collection of choice hardy Ornamental Trees and Shrubs.
Bronze Medal awarded for the Collection.

Lovat, The Right Hon. Lord, Beaufort Castle, Inverness-shire.
A grand section of Larch timber from a tree grown at Beaufort Castle, 64 years of age, and containing 108 cubic feet of sound timber.
Awarded a Diploma.

Mackenzie, Alex., Superintendent, Epping Forest, Essex.
Collection of Tree Curiosities.
Plans of Lodges for Workmen. *Highly Commended.*
Forest Illustrations. *Commended.*

Mackenzie, John Ord, of Dolphinton, Peeblesshire.
Painting of a Wellingtonia, illustrative of its gigantic proportions.

Maxwell, Wellwood H., M.P., of Munches, Kirkcudbrightshire.
A fine collection of specimens of woods grown on the Munches Estate; and illustrations of the diseases of Trees.

Methven & Sons, Thomas, Nurserymen, Edinburgh.
A numerous and varied collection of Ornamental Conifers and other choice Trees and Shrubs, *Gold Medal;* and *Special Diploma* for "Excellence in Arrangement."
Collection of Tools, Seeds, Cones, etc. *Bronze Medal.*

Palmer & Son, John, Nurserymen, Annan, Dumfriesshire.
Collection of Conifers and other Evergreens, Forest Trees, Seeds, etc.

Smythe, David M., yr. of Methven, Methven Castle, Perthshire.
Specimens of Larch, Silver Fir, and Ivy Stems, from Methven.
A Fine collection of Natal Woods and Ferns.
Diploma awarded for the Collection.

Stuart & Mein, Nurserymen, Kelso, Roxburghshire.
A collection of Conifers and other hardy Ornamental Trees and Shrubs.
Diploma awarded for the Collection.

Whitton, James, The Gardens, Coltness, Lanarkshire.
Models of Transplanting Machines and Apparatus.
Diploma awarded for Small Transplanting Machine.

THE SCOTTISH ARBORICULTURAL SOCIETY.

At a Meeting held in Edinburgh on the 16th of February 1854, at which Mr William M'Corquodale, Forester, Scone Palace, Perth, presided, for the purpose of presenting a testimonial to Mr James Brown on the occasion of his appointment to the office of Deputy-Surveyor of Dean Forest, Gloucestershire, a suggestion was made by Mr William Thomson, Deputy-Surveyor, Chopwell Wood, Co. Durham, that, as Agriculture and Horticulture had derived much benefit from Associations designed to promote their respective interests, "something of a similar kind should be done for Forestry." The suggestion was at once adopted by the Meeting, and the Scottish Arboricultural Society there and then originated.

A Committee was immediately formed to carry out the proposal, the members of which were:—James Brown, Deputy-Surveyor, Dean Forest, *President;* William M'Corquodale, Forester and Wood-Surveyor, Scone, *Vice-President;* James Alexander, Nurseryman, Edinburgh, *Secretary;* John Anderson, Nurseryman, Perth, *Treasurer;* James Balden, Forester, Lennoxlove; John Balden, Forester, Bywell Castle; Mr Campbell, Alloa; Robert Cowan, Forester, Arniston; James Dickson, Forester, Charlton; Thomas Forbes, Forester, Whittinghame; Robert Gardiner, Forester and Land Steward, Eglinton Castle; John M'Donald, Forester, Bargany: John M'Laren, Forester, Hopetoun; Hugh M'Laren, Forester, Shaw Park; Alexander M'Leish, Forester, Alnwick Castle; James Rutherford, Forester, Buckden; John Thomson, Forester, Culhorn; William Thomson, Deputy-Surveyor, Chopwell; and Thomas Taylor, Forester, Camperdown, Members of *Committee.*

Several Meetings of the Committee were held during the year 1854, at which the Constitution and Laws were drawn up, and various matters of importance discussed and arranged for the formal institution of the Society. The results of the labours of the Committee were submitted to the first "Annual General Meeting" of the Society, held at 6 York Place, Edinburgh, on 31st January 1855, Mr James Brown, *President*, in the chair, and after full consideration were unanimously approved.

The following Table shows, in a concise form, the rise and progress of the Society during the first thirty years of its existence, and indicates the great influence it has brought to bear, from a very modest beginning, on the Science and Art of Forestry in this country.

No. of Meetings.	Dates of Meeting.	Year.	President.	Secretary.	Tr
Society Instituted.	16th Feb.	1854	James Brown, Deputy-Surveyor, Dean Forest.	James Alexander.	John
1	31st Jan.	1855	Do. do.	Do.	
2	14th Nov.	1855	Do. do.	Do.	
3	12th Nov.	1856	Do. do.	Do.	
4	8th Oct.	1857	Do. do.	Do.	
5	6th Oct.	1858	Earl of Ducie.	Do.	
6	5th Oct.	1859	Earl of Stair.	Do.	
7	7th Nov.	1860	Sir John Hall, Bart.	Robert M. Stark.	
8	6th Nov.	1861	Duke of Athole.	Do.	
9	5th Nov.	1862	John J. Chalmers of Aldbar.	John Sadler.	
10	4th Nov.	1863	Earl of Airlie.	Do.	
11	2d Nov.	1864	Rt. Hon. T. F. Kennedy.	Do.	
12	1st Nov.	1865	Robert Hutchison of Carlowrie.	Do.	
13	7th Nov.	1866	Do. do.	Do.	
14	6th Nov.	1867	Do. do.	Do.	
15	4th Nov.	1868	Do. do.	Do.	
16	3d Nov.	1869	Do. do.	Do.	Thom
17	2d Nov.	1870	Do. do.	Do.	
18	1st Nov.	1871	Do. do.	Do.	
19	6th Nov.	1872	Do. do.	Do.	
20	5th Nov.	1873	Hugh Cleghorn, M.D., of Stravithie.	Do.	
21	4th Nov.	1874	Do. do.	Do.	
22	3d Nov.	1875	J. H. Balfour, M.D., Prof. of Bot., Edin. Un.	Do.	Georg
23	1st Nov.	1876	Do. do.	Do.	
24	6th Nov.	1877	Rt. Hon. W. P. Adam.	Do.	
25	5th Nov.	1878	Do. do.	Do.	
26	7th Oct.	1879	Do. do.	Do.	
27	5th Oct.	1880	Marquis of Lothian, K.T.	John M'Laren, jun.	John
28	4th Oct.	1881	Do. do.	Do.	
29	3d Oct.	1882	Do. do.	Do.	
30	2d Oct.	1883	Alex. Dickson, M.D., Prof. of Bot., Edin. University.	Do.	
31	5th Aug.	1884	Hugh Cleghorn, M.D., of Stravithie.	Do.	

SCOTTISH ARBORICULTURAL SOCIETY, 1854 to 1884.

No. of Meetings.	Date of Meeting.	Year.	President.	Secretary.	Treasurer.	Prizes Offered.	Prizes Awarded.	New Members	Total Members.	REMARKS
Society Instituted.	16th Feb.	1854	{ James Brown, Deputy- } { Surveyor, Dean Forest. }	James Alexander.	John Anderson.	..	..	19	19	The Society Instituted.
1	21st Jan	1855	Do. do.	Do.	Do.	Four	..	16	35	Constitution and Laws Approved at General Meeting. Subscriptions to be Foresters and others, 10s., Under Foresters, 5s. Addresses on the use and abuse of the Society, by the *President* and Mr W. Thomson. Five *Tree-Plus-sheets* best app anted. Motion approved to admit Members on payment of first Subscription
2	14th Nov.	1855	Do. do.	Do.	Do.	Four	Three.	25	59	First issue of complete List of Members. Subscriptions to be 1l. Annual, or £5, for Life. Foresters, 5s.; Under Foresters, 2s. 6d. Illustrative specimens of Turning exhibited at Meeting by Mr M'Corquodale, Stone.
4	8th Oct.	1857	Do. do.	Do.	Do.	Seven	Six	55	142	First Returns (59 outturns) of prices of British Forest Produce. Silver Medals first Awarded. Proposals to hold Quarterly Annual Meetings disapproved by large majority.
5	6th Oct.	1858	Earl of Dalhousie.	Do.	Do.	Six	Two.	25	167	First Honorary Members elected, viz., Dr J. H. Balfour, Sir Wm. J. Hooker, Dr Lindley, Prof. George Lawson, James M'Nab, and Peter Clark.
6	5th Oct.	1859	Earl Fife, K. T.	Do.	Do.	Four.	None.	3	170	Six *Tree-Pruduats* elected. *Secretary* resigned office.
7	7th Nov.	1860	Sir John Hall, Bart.	Robert M. Stark.	Do.	Five.	One.	16	182	Robert M. Stark appointed *Secretary*. Subscriptions fixed at—Proprietors, Nurserymen, etc., 10s. 6d.; Factors, etc., 5s.; Foresters, 2s.; Under Foresters, 2s.
8	6th Nov	1861	Duke of Athole	Do.	Do.	Seven.	None	5	159	Five prizes, of £5 each, offered, to stimulate Foresters to contribute Essays on Special subjects. Nurserymen to Subscribers to be Proprietors. Forestry petition read and proposed. *Secretary* resigned office.
9	7th Nov	1862	{ John J. Chalmers, of } { Auldbar }	John Sadler.	Do.	Five	None	5	164	John Sadler appointed *Secretary*. General Meeting resolved that the Judges' decisions shall be final.
10	8th Nov.	1863	Earl of Airlie.	Do.	Do.	Four.	Three.	8	151	M'Glashan's Transplanting Machine exhibited, and Committee appointed to test and report.
11	24 Nov.	1864	Ist Hon. T. E. Kennedy.	Do.	Do.	Five	Six.	14	162	Society's "Motto" invented by the *Secretary*. Judges not to compete for prizes which bring other Committee members Unfavourably on Mr M'Glashan's Transplanter.
12	1st Nov.	1865	{ Robert Hutchison, of } { Carbeth. }	Do.	Do.	Seven	Four	29	162	Award of £5, made at previous Meeting, to J. E. Nelson, Rickall, Hants, for Essay on "Newer Conifers," Motto "Semper," was unanimously rescinded, owing to unusual stipulations by the Author
13	7th Nov.	1866	Do. do.	Do.	Do.	Six	Ten.	62	220	Committee appointed to establish, in Edinburgh, a Forester's Registry Office. The *Transactions* presented with a handsome silver plate Testimonial. The Annual Dinner instituted.
14	6th Nov.	1867	Do. do.	Do.	Do.	Eleven	Four.	69	284	Education and Training of Foresters discussed by Prof. J. H. Balfour, who says—He would see Arboriculture could be better taught and learned in Britain than elsewhere. The *President* presented Medal and cup to the Society.
15	4th Nov.	1868	Do. do.	Do.	Do.	Thirteen	Eleven.	87	367	Deputation waited on British Association regarding assistance in testing the Influence of Forests on Climate. Prof. Fergusson elected Honorary Member. Report on the Forest Services of India and in British Forests.
16	3d Nov.	1869	Do. do.	Do.	Thomas Methven	Seventeen.	Eleven.	100	464	Her Majesty The Queen became Patron of the Society. Thos. Methven, *Treasurer*, and J. Anderson, resigned. Mr D. Mitchell gave a Ten Guineas Cup for a practical Essay on Arboriculture. Collections of Cones exhibited from England, Scotland, and Ireland.
17	23 Nov.	1870	Do. do.	Do.	Do.	Seventeen.	Thirteen.	85	543	Committee named to investigate the influence of Forests on Climate, the British Association giving a contribution of £25. Proposal to grant Diplomas for Efficiency in Forestry postponed.
18	1st Nov.	1871	Do. do.	Do.	Do.	Nineteen.	Thirteen.	74	612	To meet in Provincial work and place. Subscriptions fixed at—Nurserymen, Factors, etc., 10s. 6d.; Foresters, 5s., and Under Foresters, 2s. Numerous Exhibits at General Meeting—Cones, Woods, Photos, etc.
19	6th Nov.	1872	Do. do.	Do.	Do.	Eighteen.	Seventeen	82	658	To extend the usefulness of the Society, it was agreed to devote two days to the Annual Meeting, to Excursions on selected subjects, and to appoint a subject to be read at next Excursion Meeting. Report and Prize Essay read.
20	7th Nov.	1873	{ Hugh Cleghorn, M.P., } { of Strathtyrum }	Do.	Do.	Nineteen.	Ten.	57	665	Meeting first held in Royal Botanic Garden. Donations to special subjects inaugurated with success. Numerous exhibits of Cones, Plants, Tools, etc. Museum of timber opened.
21	6th Nov.	1874	Do. do.	Do.	Do.	Twenty.	Fifteen.	45	681	Dr Balfour in Inaugural Address forcibly pointed out the advantage of planting waste land in Britain. Memorial sent to Government in favour of the Act. Prize. George Crichton, *Treasurer* vice T. Methven, resigned.
22	4th Nov.	1875	{ J. H. Balfour, M.D., } { Professor, Edinburgh }	Do.	George Crichton.	Eighteen.	Twelve.	56	698	The Transactions of the great need for a British Forest School; and sketched out a curriculum. Committee appointed to draw up a New Code of Laws and Regulations.
23	1st Nov.	1876	Do. do.	Do.	Do.	Twenty.	Eleven.	74	751	New Code of Laws and Regulations submitted and approved. Discussion on "A Journal of Arboriculture" led. Messrs Robert Shand & Son, London, to publish the "Journal of Forestry" in May 1877.
24	6th Nov.	1877	Rt. Hon. W. P. Adam.	Do.	Do.	Twenty-four.	Six	46	794	Local Secretaries (14) first appointed. The *Transactions* presented by the Society with an Illustrated Album of "The Trees of Perthshire."
25	5th Nov.	1878	Do. do.	Do.	Do.	Twenty-four.	Thirteen	43	730	First Excursion of the Society, to Scone Estates. Council to inquire and report on getting a Royal Charter for the Society. Fine collections of Cones, Seeds, Firms, Photos, etc., exhibited.
26	7th Oct.	1879	Do. do.	Do.	Do.	Twenty-five.	Nine	41	732	Excursions to Dunkeld and Athole Forests; Dalkeith Park and Cattle Abbey. Education or matter appealed. John M'Laren, jun., appointed *Secretary* vice John Sadler, resigned, and Treasurer vice Crichton, retired.
27	5th Oct.	1880	Marquis of Lothian, K.T.	John M'Laren, jun.	John M'Laren, jun	Twenty-eight.	Twelve.	74	740	Excursions to Dolphinton, Tweedbank, and Penicuik; and Heriot-town. Charter and Education Reports approved and remitted. Horrie's Hedge Cutting Machine exhibited in operation.
28	3d Oct.	1881	Do. do.	Do.	Do.	Twenty-nine.	Sixteen.	53	715	Excursions to Moray shire and East Lothian. At the suggestion of the *President* special prizes offered to Assistant Foresters. Education remitted to the Council. Sir Richard Temple, Bart., addressed a Meeting on Forestry.
29	2d Oct.	1882	Do. do.	Do.	Do.	Thirty-four.	Twelve.	70	695	Excursions to Dumfriesshire and Eske. The Council, after careful inquiry, strongly recommend the creation of a British School of Forestry. Proposal to hold International Forestry Exhibition and rejected.
30	24 Oct.	1883	{ Alex. Dickson, M.D., } { Prof. of Bot., Lon. } { University. }	Do.	Do.	Twenty-nine.	Thirteen	70	756	Excursions to Upper Strathearn and Ettrick Forest. The forthcoming International Forestry Exhibition the chief topic of discussion at Meeting and of the work for the season.
31	5th Aug.	1884	{ Hugh Cleghorn, M.D., } { of Strathtyrum. }	Do.	Do.	Thirty-one.	Five.	60	772	Excursions to Riccarton and Strathclyde Forests. International Forestry Exhibition received the principal attention during the season. The Society and Memberses visited numerous and valuable collections.

THE INTERNATIONAL

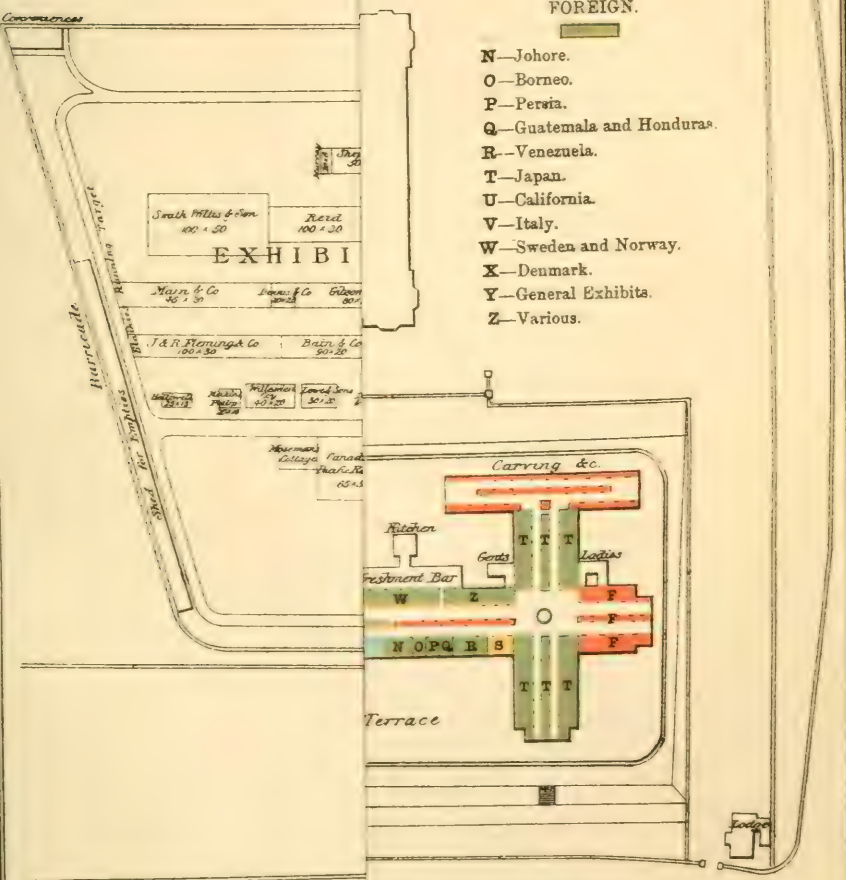
PLAN

REFERENCES.

K—Cape Colony.
L—Mauritius.
M—Br. Guiana and St. Vincent.
S—New Brunswick.

FOREIGN.

N—Johore.
O—Borneo.
P—Persia.
Q—Guatemala and Honduras.
R—Venezuela.
T—Japan.
U—California.
V—Italy.
W—Sweden and Norway.
X—Denmark.
Y—General Exhibits.
Z—Various.



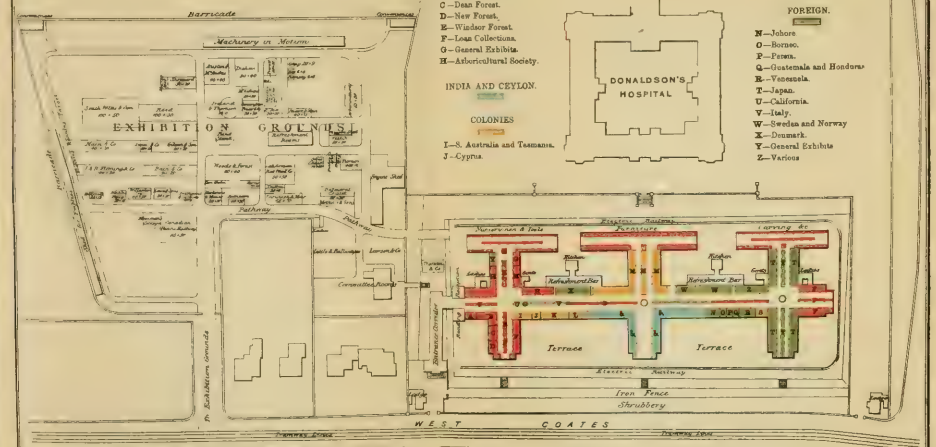
South Transepts, . . .
Centre of Main Transept, .
North Transepts, . . .
West Annexe, ...
Centre Annexe, ...
East Annexe, ...
East End of Main Transept, .

OU

Shedding, ...
Open Ground, ...

The International Forestry Exhibition 1884

Plan of Buildings



REFERENCES.

BRITISH.

A—War-office.
B—Epping Forest.
C—Dean Forest.
D—New Forest.
E—Windsor Forest.
F—Loan Collections.
G—General Exhibits.
H—Arboricultural Society.

INDIA AND CEYLON.

COLONIES

I—S. Australia and Tasmania.
J—Cyprus.

REFERENCES.

K—Cape Colony.
L—Mauritius.
M—Br. Guiana and St. Vincent.
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T—Japan.
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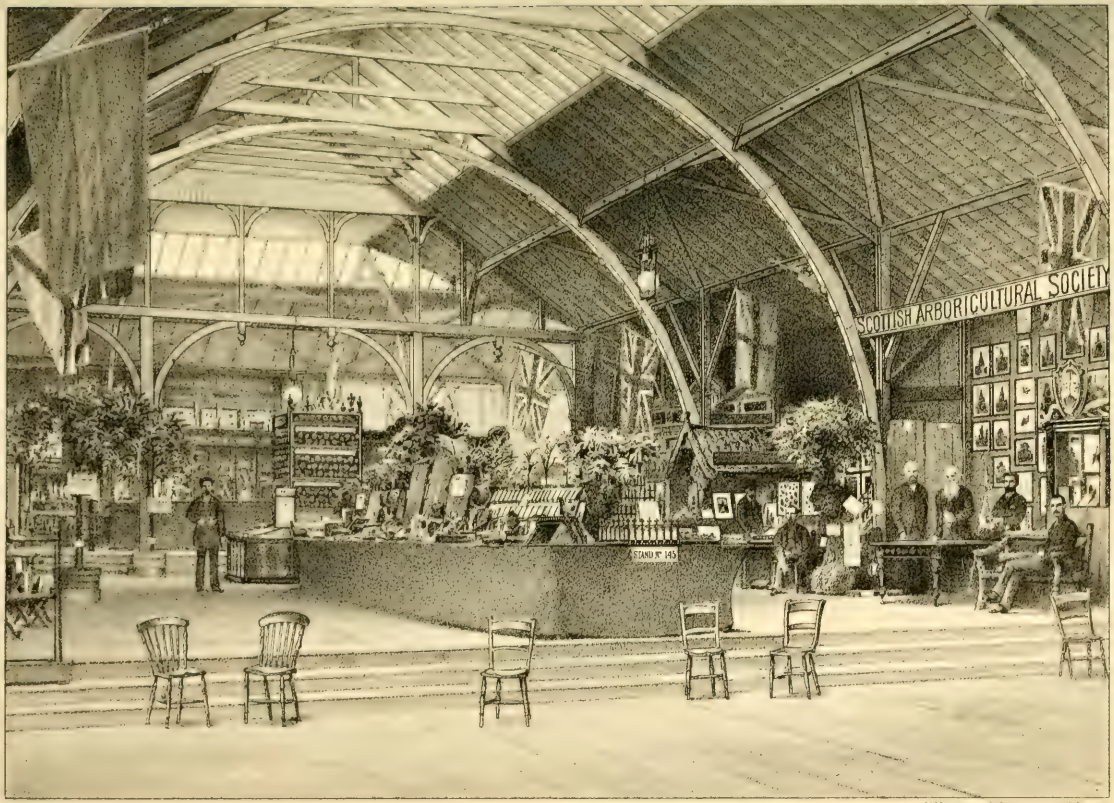
V—Italy.
W—Sweden and Norway
X—Denmark.
Y—General Exhibits
Z—Various

South Transepts,	Nos.	1 to 49
Centre of Main Transept,	,,	50 to 129
North Transepts,	,,	130 to 149
West Annexe,	,,	150 to 171
Centre Annexe,	,,	172 to 190
East Annexe,	,,	191 to 234
East End of Main Transept,	,,	235 to 309
OUTSIDE.		
Shedding,	,,	310 to 330
Open Ground,	,,	331 to 380

INTERNATIONAL FORESTRY EXHIBITION, EDINBURGH, 1884.

INTERNATIONAL FORESTRY EXHIBITION, EDINBURGH, 1884.

SCOTTISH ARBORICULTURAL SOCIETY'S EXHIBITS IN NORTH-WEST TRANSEPT.



INTERNATIONAL FORESTRY EXHIBITION, EDINBURGH, 1884.

SCOTTISH ARBORICULTURAL SOCIETY'S COURT.

INTERNATIONAL FORESTRY EXHIBITION, EDINBURGH, 1884.

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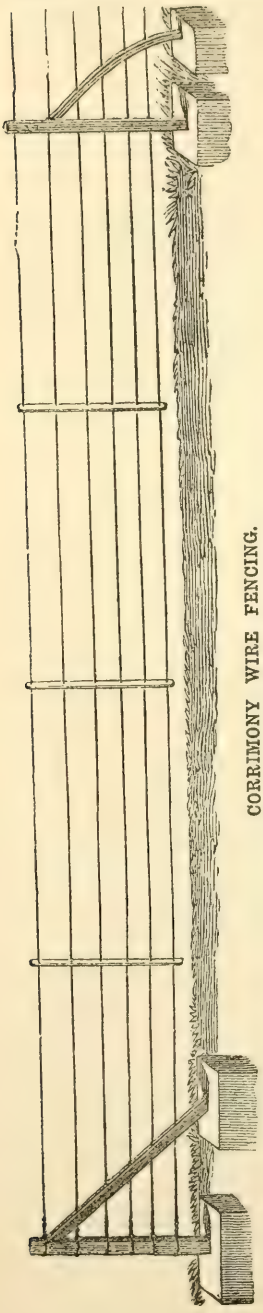

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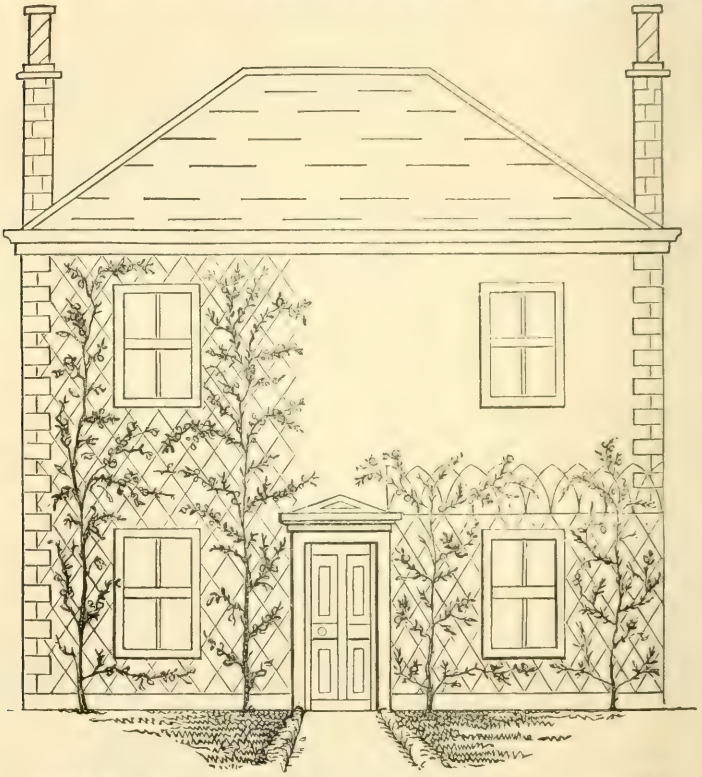

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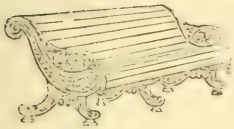

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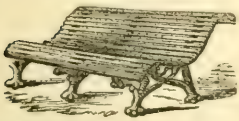

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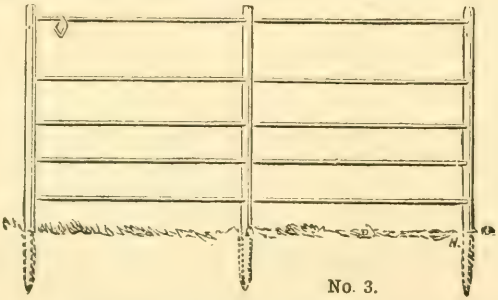

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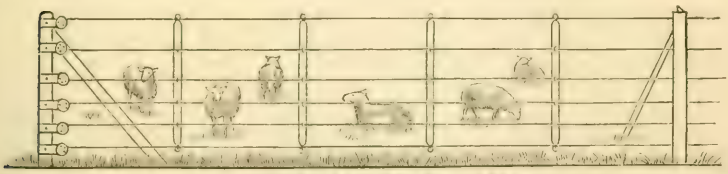
Wrought-Iron Flat-Bar Continuous Fences, suitable for Horses, Cattle, or Sheep.
Wrought-Iron Round-Bar Continuous Fencing, suitable for Horses, Cattle, or Sheep.
Strong Wire Fencing, with Wood Posts, for Sheep, Cattle, or Horses.
Strong Wire Fencing, with Pronged Iron Standards, for Cattle or Horses.
Patent Corrimony Wire Fencing, with Patent Standards and Patent Droppers.
Improved Unclimbable Hurdles, for Temporary Fences or Enclosures.
Wrought-Iron Hare and Rabbit Proof Hurdles. Wrought-Iron Tree Guards.
Improved Wrought-Iron Hurdles, for Sheep or Light Cattle.
Ornamental Wire Hare and Rabbit Proof Hurdles. Plant Guards.
Ornamental Wire Garden Borders. Iron and Wire Flakes for Gardens.
Wrought-Iron Kennel Rails, all kinds. Galvanised Wire Netting, machine and hand made.



LETTERS PATENT, No. 13,341,

Drawing shows Bain, Young, & Co.'s Patent Corrimony Iron and Wire Fencing (the best and cheapest of this class of Fencing in the market), with Patent Lockfast Steel Droppers and Patent Lockfast Iron Standards, all of which form a most suitable, efficient, and durable Fence for Cattle, Sheep, etc., etc. Experts say this is the cheapest and Best Dropper Fence in the market. The Patent Steel Droppers and Patent Standards, Wire, etc., can be supplied to parties erecting their own Fences; also the Patent Droppers are supplied to parties who may use wood posts or otherwise, and are easily fixed on to the Wires after the Fence is strained up. For Colonial use, where long stretches of Fencing are erected for Sheep, etc , this Patent Corrimony Fencing, on account of its cheapness, durability, and being so easily fitted up, is highly recommended.

Detailed Price Lists and Drawings Free on application.

A NEW DROPPER
FOR CORRIMONY FENCING,

AWARDED DIPLOMA OF HONOUR, INTERNATIONAL FORESTRY EXHIBITION, 1884.

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Adopted by all the leading Proprietors in the Country.

Features—
Lightness, Strength, Handiness, and Durability.

WE have to bring under the notice of landed proprietors in the Highlands and elsewhere a very important and novel series of Patented Inventions and Improvements in Corrimony Wire-Fencing. The general features of the Corrimony system, and the many advantages it possesses over other systems for traversing undulating ground, are well known; but since the days of the primitive wooden dropper, the invariable method adopted has been to fix strips of iron to the wires, by means of wedges, or small pins of one sort or another. But, besides being a tedious operation, the fixing of these wedges soon proved to be entirely ineffective, as, from the force of the wind, attacks of cattle, and other causes, it was only a matter of time for the wedge to work loose, and the cost of keeping the fences in repair to become an expensive item.

"The 'Lockfast' Patent Dropper, which is manufactured by Messrs WILLIAM SMITH & SON, Ness Iron Works, Inverness, N.B., is a distinct departure from, and a vast improvement on, any other system in use that we know of."—*Journal of Forestry*, December, 1883.

The Lockfast patent consists of only *two parts*, while *all others* have at least *three*. All other droppers are secured by means of pins or wedges, which are liable to become loose, but the patent of the Lockfast is in the application of the eccentric (one of the most powerful forces in applied mechanics), and while its grip is unrelenting when locked, it can be unlocked with its key, and relocked, with the greatest of ease.

Mr OGILVY of Corrimony writes:—"I can express a very favourable opinion of your Patent Lockfast Dropper. I consider it to be the best suited for the Corrimony fence of any dropper I have seen. Its principle is equally simple and efficient."

Dr MACKENZIE of Eileanach says:—"To those who need fences, I can recommend Smith's admirable Lockfast Dropper."

Prior VAUGHAN, The Abbey, Fort-Augustus, says:—"In rigidness, neatness, and strength, it surpasses any I have yet met with."

Mr JAMES A. SMITH, Commissioner for Mr Balfour, M.P., writes:—"Your 'Lockfast Dropper' gives great satisfaction here—it is very suitable, being handy, easy to work, and having great gripping power."

The Manager on an extensive island estate in the West writes:—"I have pleasure in giving my testimony in favour of your 'Lockfast Dropper,' and *that* after a trial of all the patent droppers in the market."

Mr D. JOHNSTON, Wire-fencer, Foyers, writes, May 30, 1883:—"We place from 400 to 500 Droppers in a day of 10 hours for each man; sometimes one man will place as high as 600."

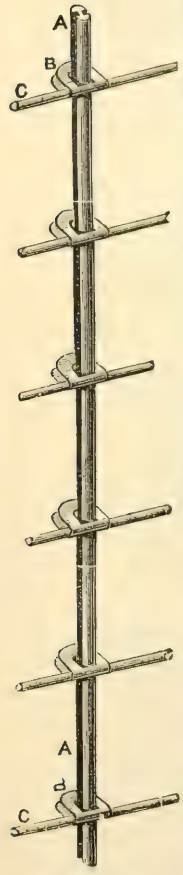
Mr C. STEWART, Forester, Invermoriston, writes:—"They are superior to any I have seen yet."

Journal of Forestry, December 1883:—"It is evidently the outcome of a long experience and patient study, for simple as it appears, it is a very ingenious contrivance."

"Martineau & Smith's Trade Journal" says:—"The makers of the 'Lockfast Dropper' not only economise in the process of manufacture, but secure for the consumer a direct saving of labour during the process of erection."

Hundreds of Testimonials have been received.

FIG. 4.



A Dropper fixed, complete.

FIG. 1—shows Dropper Unfixed.

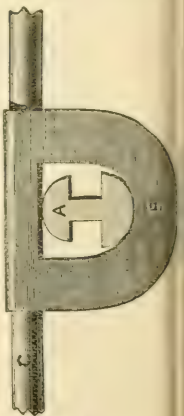


FIG. 2—shows Dropper Fixed.

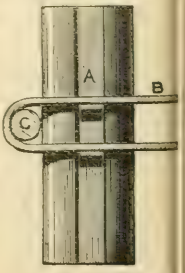


FIG. 3—Side View.

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TRANSACTIONS

OF THE

SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XI.—PART II.

SECRETARY AND TREASURER,
JOHN M'LAREN, JUN.,
FELLOW OF THE BOTANICAL SOCIETY, EDINBURGH.

EDINBURGH:
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The Society, as a body, is not to be considered responsible for any statements or opinions advanced in the several papers, which must rest entirely on the authority of the respective authors.

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TRANSACTIONS

OF THE

SCOTTISH ARBORICULTURAL SOCIETY.

VII. *President's Address—Delivered at the Thirty-second Annual Meeting.* By Hugh Cleghorn of Stravithie, M.D., LL.D., F.R.S.E.

Gentlemen,—In thanking the members of the Society for my re-election as President, I must apologise for coming before you without a formal address. My visit to London, to give evidence before the Parliamentary Committee on Forestry, and other important engagements, have fully taken up my spare time.

The Society has now existed for thirty-two years, and I venture to say that its efforts have been successful in stimulating concerted action in regard to the very wide range of subjects which it is specially designed to promote. The Society has now attained an important position. The number of members is nearly 800, showing a good increase on the previous year. Upwards of a hundred volumes of valuable works, chiefly in Forest literature, presented at the close of the Forestry Exhibition, have been added to the library. The annual statement of accounts, now before us, shows a balance of £205 at the credit of the Society.

The great event of the past year in our department of work was, of course, the International Forestry Exhibition. There can be no doubt that the late exhibition gave a great impetus to the Science of Arboriculture, and benefits direct and indirect have resulted. Many excellent accounts of it have appeared in various publications; but as a connected description *tout ensemble* of the whole Exhibition, I may refer you to an article by Messrs Dunn and M'Laren in the last part of our

Transactions, and to another in the Introduction to the volume of "Prize Essays," in connection with the Exhibition, just published,* from which I make extracts.

"The Scottish Arboricultural Society, not content with starting and pressing forward the scheme for the Exhibition, contributed largely, the exhibits occupying the greater part of the northern division of the western transept and a large adjoining space in the nave. Meteorological instruments, dendrometers, tools used in forestry, models of bridges and river embankments, and specimens of woods were shown, and illustrations given of the durability of posts and sleepers in exposed situations. Cones of the rarer coniferæ, fungi, and insects injurious to trees, specimens of grafting, pruning, and other operations, paintings and photographs of trees, dried leaves, models of foresters' houses, rustic and elaborately artistic wood-work, illustrated the wide range of subjects and sciences touched upon by forest work."

"The extensive 'Loan Collection,' contributed by about 150 exhibitors, which was placed at the disposal of the Executive Committee, occupied the central tables in the nave. It formed a miscellaneous museum of Natural History objects—birds, insects, plants—specimens of ornamental panels, picture frames, beautiful carvings, models of ships, bridges, salmon-ladders, railways and buildings, and of curiosities of every kind."

"In the three annexes many articles of great practical significance and economic value were displayed—machinery used in forest work and in the manufacture of wood products; manufactured goods, such as furniture of all descriptions, from the plainest to the most ornate; exquisite inlaid work; walking-sticks, fishing-rods, and indiarubber, native and manufactured. Many things of more strictly scientific interest were also present, such as microphotographs, microscopic objects, cones, barks, and other specimens."

With the view of extending the knowledge of the public on Forest questions, arrangements were made by which popular lectures should be delivered at intervals during the time the Exhibition lasted. The programme included the following subjects:—(1.) "Outlines of Forestry in Europe," by Dr Lyons; (2.) "Wood," by Professor M'Nab; (3.) "Timber-destroying

* *Forestry and Forest Products.* Edited by John Rattray and Hugh Robert Mill. Edinburgh, David Douglas, 1885.

Molluscs," by Professor M'Intosh; (4.) "The Forests of New Brunswick," by Mr E. Jack; (5.) "Eucalyptus," by Dr Howitz; (6.) "The System of Forest Surveys in India," by Major Bailey; (7.) "Sporting Trophies," by Colonel Michael; (8.) "The Forests of Johor," by Mr Meldrum; and (9.) "The Management of Cumberland Plantations," by Mr W. Baty.

"Upwards of half a million people passed the turnstiles in the three months during which the Exhibition was open, and although, at first, the admission fee was so high as to make the attendance sometimes rather meagre, at a later date, when the exhibits had been got into proper order, a daily average of from 4000 to 5000 was attained. Every facility was offered for the convenience of visitors by season tickets, charged at different rates, according to the date of issue, and by special arrangements for the admission of large parties."

In August 1883, Sir John Lubbock, on the vote being taken in Parliament for the Crown Woods and Forests, lamented the absence of a British Forestry School; and recently the Highland and Agricultural Society of Scotland and the Scottish Arboricultural Society, amongst others, warmly supported the scheme for the establishment of such an institution. It has been said, it is true, that Great Britain does not possess such a school, because no extensive Government Forests exist, and because her abundant supply of coal renders the people independent of wood for fuel; but when it is remembered that the system of Forest Conservancy, as carried out in India, has proved an important source of revenue to the country, while at the same time insuring permanence of the timber supply; and when it is also borne in mind that, according to authoritative report, upwards of ten million acres, which are at present of but nominal value, in Great Britain and Ireland, might, if put for a few years under trained conservators, become important sources of wealth, no doubts should exist in the public mind as to the advisability of establishing a Forest School.

"The forests of Norway and Sweden, which not many years ago had so little monetary value as to justify their owners in burning them in order to procure a cereal crop from the soil enriched by their ashes, have now been placed under strict conservancy, and with good results; while the immense, though diminishing, wood-producing tracts of America, are also being gradually subjected to similar supervision, since the necessity for so doing has become too imperative to be neglected. As Great Britain

possesses in her dependencies a larger acreage of woodland than any other nation, it is obviously important to provide a staff of thoroughly trained practical foresters."

"To Edinburgh is due the credit of first taking up the idea of a Forest School, and, with a view to its establishment, the Town Council, some years ago, purchased the Arboretum adjoining the Royal Botanic Garden for £20,000. Handsome donations have been received from various Governments and private exhibitors at the International Forestry Exhibition for the foundation of a Forestry Museum; and although, unfortunately, the surplus of the Exhibition is not sufficient to secure the immediate establishment of a chair of Forestry, the people of Scotland, and of Great Britain and Ireland generally, only require to realise the importance and necessity of such a scheme, in order to unite and carry it into effect; thereby removing the slight that at present attaches to our country in this respect."

Many years ago Sir Robert Christison first urged the need of a school; Professor Balfour called attention to it in 1876; Mr Hutchison spoke of it in 1877; and before going out to Madras, the Right Hon. W. P. Adam bore testimony to the great importance of the subject. Mr Adam left his manuscript with me, and I read it the other day to the Forestry Committee of the House of Commons. The Marquis of Lothian has also spoken very effectively in favour of the proposal, and now presides over the Committee appointed to carry out the scheme of a Forest School.

For the establishment and endowment of a School of Forestry, a sum of £10,000 would be required. A sum of about £800 has already been promised to the Committee. That is certainly a small sum, but we trust that, with this commencement, matters will proceed rapidly towards the complete attainment of the important object we have in view.

On the 15th of May 1885, on the motion of Sir John Lubbock, Bart., it was ordered—"*That a Select Committee be appointed to consider whether, by the establishment of a Forest School, or otherwise, our Woodlands could be rendered more remunerative.*" The Committee met for deliberation on the 14th July, and it is understood that sufficient proof has been adduced to report progress, and to recommend a continuation of the Committee next session.

REPORT OF THE SELECT COMMITTEE OF THE HOUSE OF COMMONS, 1885, ON FORESTRY.

On the 15th of May 1885, on the motion of Sir John Lubbock, Bart., it was ordered—"*That a Select Committee be appointed to consider whether, by the establishment of a Forest School, or otherwise, our Woodlands could be rendered more remunerative.*"

The Committee was nominated on the 8th of July, and ultimately comprised the following nineteen members of the House of Commons :—Mr William Corbet, Dr Farquharson, Mr Fremantle, Mr William Henry Gladstone, Sir G. Macpherson Grant, Sir John Kennaway, Sir Edmund Lechmere, Sir John Lubbock, Dr Lyons, Sir Herbert Maxwell, Colonel Nolan, Mr Parnell, Mr Plunket, Mr Portman, Mr Round, Mr Seely, jun., Mr Moore Stevens, Mr Villiers Stuart, and Colonel King Harman.

It was ordered that Five Members form a *Quorum*, and that the Committee have power to send for Persons, Papers, and Records.

The Committee met for deliberation on the 14th July, when Sir John Lubbock was elected Chairman, and adjourned till the 21st July. On that date the Committee met and examined two witnesses—Mr William G. Pedder and Colonel James Michael, C.S.I., and then adjourned to the 24th July, when it heard the evidence of Dr Hugh Cleghorn, Colonel George Pearson, Mr W. T. Thiselton Dyer, and Mr Julian Rogers ; after which the following report was proposed by the Chairman, Sir John Lubbock, Bart., duly read, and agreed to :—

"*Your Committee are of opinion that at this late period of the Session it will not be in their power to conclude their investigation ; they have therefore agreed to Report the Evidence already taken to the House, and to recommend that a Committee on the same subject should be appointed in the next Session of Parliament.—24th July 1885.*"

The evidence tendered by the witnesses during their several examinations is of a very comprehensive nature, and although the details are more or less interesting, they are too voluminous to be given in full in the Society's *Transactions*. However, those who desire to peruse the Parliamentary Report may procure it for 7½d. through any bookseller. In the following copious extracts the gist of the inquiry and its bearings on British forestry is given.

The first witness called was Mr WILLIAM G. PEDDER, head of the Revenue Department of the India Office, who, in his evidence, gave an interesting account of the inception and development of the Forest Department of India to its present satisfactory and flourishing state. He quoted largely from official returns and statistics, showing the methods of working, and the prosperous condition of the Forest Department in India. He also gave many interesting details as to the training of forest officers, and pointed out the numerous benefits accruing to India since the establishment of the Forest Service.

Colonel JAMES MICHAEL, C.S.I., late of the India Forest Service, was the next witness examined, and to questions put by the Committee, replied as follows :—

"You were, I believe, at the inception of the Forest Service in India?" "I was."—"Will you kindly tell the Committee what were the first steps taken in the Madras Presidency in regard to the promotion of forests?" "I must premise that I can merely give information regarding the early stages of forestry in India, and simply of the Madras Presidency, because I had, after seven years' pioneering, to leave the Forest Department, my health having suffered so much from jungle fever. But I have ever since taken the greatest interest in the subject, and have studied the progress of it, and have always kept myself well *au fait* as to what was going on. As Mr Pedder has already told the Committee, in the first instance the Bombay Government began to feel the pinch (as Sir George Birdwood expressed it in one of his papers upon the matter) of not getting sufficient timber for the Bombay dockyard. Ships used to be built there for the Royal Navy; and they established a Conservancy Department in Bombay, in 1846, mainly for the purchase of timber; and in a year or two after that the first actual steps towards the Government taking forests into their own hands and working them and conserving them, and, in short, starting a Forest Conservancy Department, originated in Madras through General Frederick Cotton, of the Engineers, who suggested to the Madras Government that they should thus take the southern forests in hand. Upon his recommendation the Government appointed me to commence the first experimental scheme in 1848. I hardly like to talk much about myself, but I might hand in a letter which appeared in the "Journal of the Society of Arts" in 1882, written by Sir George Birdwood; I think the honourable

Chairman will recollect the circumstance, as he presided on the occasion of a paper being read by Colonel Pearson, who, in alluding to the commencement of the Forest Department of India, commenced with the year 1857. Upon that Dr Birdwood (now Sir George) wrote a letter, published in the "Journal of the Society of Arts," in which he mentioned that just ten years before that date the foundation upon which the Forest Department was constructed had been deeply laid in the Madras Presidency when Major-General Frederick Cotton, who was then a captain in the Madras Engineers, first drew the attention of the Government of Madras to the subject. And then he goes on to say that I was appointed to carry out the experiment, and that in consequence of the success of that undertaking between 1848 and 1856, the Court of Directors sanctioned the application of these plans to other forests in the Madras Presidency, and directed the formation of a regular Forest Department, which was commenced then, and spread throughout the whole of India."—"Have you any idea how that came to be originated with General Frederick Cotton?" "I know perfectly, because I saw a great deal of him at that time, as I was placed under his orders. Riding across the southern forests of the Madras Presidency, then unexplored, he was struck with the bad order in which they were kept, being destroyed as they were by Government leasing them out to contractors instead of keeping them in their own hands. It struck him that if the Government would put a stop to that system, this terrible waste would be stopped, and he urged the matter upon the Madras Government. Upon his recommendation those steps were taken. He was asked if he would undertake to put a stop to waste in, at all events, a small portion of the forests. He consented, and he asked for me as an assistant, as we had been much together; my regiment had been stationed at the same place, and we had hunted together. Having known me in this way he asked for my services, as he also knew I had had some little experience of forestry in Europe before I entered the army." . . .

"Do you think it desirable that a forest school should be established in this country?" "Certainly, it could not fail to be of value to the country."—"Irrespective of giving training for India?" "Yes. I think for the country generally it would be immensely valuable for landowners and men who own large woods in this country if they could have men with better training than those they have now."—"Is it not a fact that great proprietors frequently are in want of good scientific information as to the forest

products, and do not know where to look for it?" "I have certainly heard so. When I was in Scotland at Dunkeld and Blair Athole, I remarked the forests there; I daresay you remember Mr John M'Gregor, the forester who was on the jury at the Edinburgh Forestry Exhibition; I went round with him, and know that he has a difficulty in finding men suitable for his work."

"Do you know that there is considerable difficulty in disposing of English bark at present?" "I do not know that."—"Have you heard any complaints from the proprietors of large woodlands that they find it very difficult to dispose of their bark, and that they do not know what is the matter with it?" "I am not aware of that."—"A proprietor who owns a large property in this country, and also in Ireland, complained to me that he could not sell his bark now to the same advantage as formerly, and he did not know very well where to get advice about it, or what was wrong about it; you would not doubt that a scientific and practical forester would be well able to settle a question like that, and that it would be very important to the proprietors of woods that there should be some authority in the country to whom one should be able to refer questions of that sort?" "I should think that there must be people in this country who would know the reason why the bark did not fetch a fair price."—"Would you not think it desirable that there should be a supply of persons skilled in forestry who should be able to decide upon a question of that sort?" "Certainly."—"You believe that it would have a considerable effect upon the commercial operations in regard to forest products in this country if there should be a knowledge of these things easily available, and the skill to deal with them?" "I have no doubt of it."

"Have you any experience of the great forest products in India, turpentine, resin, bark, and so on." "Yes, a great deal. I took up that subject when I first had charge of the southern forests; in fact I began collecting these things myself on behalf of the Government, not as a source of revenue so much as for the benefit of the people of the jungle. I wished to conciliate them, and at the same time to get them to help me in the matter of conservancy, and therefore I took to buying from them all the various indigenous hill or jungle produce, such as barks, gums, resins, wax, cardamons, ginger, &c."—"If a system of collecting and disposing of forest products were instituted in this country, would it not necessarily lead to very considerable industries, which would be of

great use amongst the populations where those industries would be established?" "In this country, I should think there must be many already, but of course my experience in that subject is limited to India, where the products are so much more numerous."—"They are utilised in India now to a larger extent, are they not?" "They are all utilised, and now form a very large source of revenue; but there must be also a large number of forest products in Europe—resins, gums, and so on." . . .

"Are you aware that the forest products imported into this country amount to 31½ millions sterling per annum?" "I can quite believe that, judging from the value of forest products which are to be got out of the forests in India, as evidenced by the collection sent to the Edinburgh Forestry Exhibition—drugs, gums, resins, oils, and fibres. There is an enormous industry, which I think will come forward, in these raw materials, especially in papermaking substances."—"You have no returns which would show the value of the timber imported into this country, which is about from 16 millions to 20 millions sterling, the rest being represented by the importation of resins, gums, and so on?" "The report which I have perused of Mr P. L. Simmonds' Paper, read in February last, treats only of the teak supply, but it shows that in 1883 there were £647,000 worth of teak imported into England."

"Have you any suggestions you would wish to make as to the present training of Indian forest officials, or are you satisfied with it?" "I am very glad to find that they are going to train them in their own country instead of entirely abroad, for my experience is that some of the younger men who were trained abroad were under great disadvantages from not knowing the language sufficiently. It is very much better that a man should be trained in his own language than in a foreign one, which he understands only partially. It takes him a long time to learn the language, and to understand what he is learning in fact.

"Have you paid any attention to the state of the woodlands in Great Britain and Ireland?" "Merely as an amateur, going through the New Forest or Windsor Forest; in fact, I live at Ascot, close to Windsor and Swinley, and it interests me very much to see what goes on in those forests; but I cannot say that I have any personal knowledge of English woodlands."—"From what you have seen, would you consider that the management of our woodlands in this country is altogether satisfactory, or would

you think it susceptible of improvement?" "I often see things, when I go through woods, which I think I could improve. I do not think sufficient attention is paid to judicious thinning and pruning."—"May I take it that the result of your experience in India, and your observations in this country, has been to impress upon you that the management of our woodlands might be improved, and that a forest school in this country would have very beneficial effects?" "Certainly."

Dr Hugh Cleghorn, M.D., F.R.S.E., President of the *Scottish Arboricultural Society*, and late of the India Forest Department, was the next witness examined, and gave the following replies to the questions put to him by the Committee :—

"You took an active part in the formation of the Indian Forest Department, did you not?" "I was appointed in 1856, at the same time as Dr Brandis; I was in Madras when Dr Brandis began in Burmah."—"You were for twelve years Conservator of the Madras forests, were you not?" "Yes, in Southern India."—"After that you introduced the forest system in the Punjaub?" "I was in the Punjaub under the Earl of Elgin and Lord Lawrence introducing the system there." . . . "I need hardly ask whether you are of opinion that the formation of the Indian Forest Department has been of great advantage to the country?" "I think there can be no possible doubt that it has been an immense benefit."—"In fact, you consider that a trained staff is essential to the management of forests and woodlands?" "Undoubtedly it is very essential."—"And that would apply to every country, would it not?" "It would, including Britain."

"You returned from India in 1868, did you not?" "I did, and retired from the service in 1869."—"For the last sixteen years you have paid considerable attention to the subject of our English woodlands?" "After I retired, under direction of successive Secretaries of State, I have had to do with the examinations of candidates for Indian Forestry in London, and also for the Highland and Agricultural Society in Edinburgh for subordinate grades."—"And you have paid attention to the state of our woodlands?" "Yes; particularly Scotland and England, but I have seldom visited Ireland."—"You accompanied M. Boppe?" "Yes, I accompanied the three French Professors through Scotland."—"Is it your impression from what you have seen that if we had more trained officials our woodlands would be rendered more remunerative?"

"I think there can be no doubt about it; it is marvellous that we should not at an earlier date have begun to adopt some means to preserve them."—"You would apply that not only to the superior officials, but also to the subordinate officers?" "Yes, to the managers, and to the subordinate officers or woodreeves."—"Your opinion is, that we are in England very good arboriculturists, but not very good sylviculturists?" "No country in the world has such fine specimens of trees in point of arboriculture, but as regards sylviculture we are deficient; the one is what is called *jardinage*, and the other is professional forestry."—"In the production of fine specimens of trees we stand high?" "We stand higher than any other country." . . . "I suppose the selection of species, the choice of soils, the situation, the mode of planting, the mode and degree in which the thinning should be carried on, and determining the time of felling the timber, so as to obtain the best results, are questions with regard to which skilled training is of great importance?" "All those matters require skilled training, and much observation and care."

"Is it the general opinion of those who are conversant with our woodlands that the establishment of a forest school would be of great advantage to this country?" "I think it is universal. The Highland and Agricultural Society expressed their very great gratification when they heard that Parliament was taking the matter up, and the Scottish Arboricultural Society acted in the same way. On all hands there is a general feeling of satisfaction in favour of the movement."—"The late Mr Adam (who was so much respected in this House), the late Governor of Madras, expressed a very strong opinion on the subject before he left this country?" "He was President of the Scottish Arboricultural Society, and expressed his views a few weeks before he sailed. I have the volume with me, if the Committee would like to hear it."—"Would you kindly read the paragraph?" "The Right Honourable W. P. Adam, in an address delivered in Edinburgh on 7th October 1879, said: 'I regret much that in face of this improvement, which still requires extension, we have yet to lament the want of a School of Forestry. This portion of our educational system, tending so much to the benefit of the State, is undertaken by every nation of any consequence except our own. I trust this neglect of an important branch of our national well-being will not be continued; and considering the importance of the forests of our Indian empire and colonies, we shall not always have to send young foresters to be taught their

business abroad. It may be said that we have no large forests in this country under the care of Government in which this course of instruction can be given satisfactorily and systematically; but I do not think this argument holds good. There are many extensive woodlands which may be visited and examined, but the practical part of the training does not necessarily require a great extent of forest. I believe, looking to the addition lately made to the area possessed by Government in these [Botanic] gardens, that a School of Forestry might be established in this very place, where all the operations of forestry might be practised and taught, and where young men could learn as much as in Germany or France. The forests in those countries are not planted, pruned, and tended as our woodlands are, but in many cases are self-sown; and experience in them does not necessarily fit a man to superintend all the operations of home forestry. Occasional visits to large woodlands, and a survey of the operations carried out on a large scale, which have been taught here in detail, would of course be required; but I maintain that for all practical purposes of home work, perfect training might be given here.' This address was given a few weeks before Mr Adam sailed; he left the manuscript with me, and I had it printed."—"You would consider that Mr Adam, from the attention he had paid to the subject, was very well qualified to express an opinion?" "He had a large extent of woodland himself, and he was President of the Arboricultural Society for some years."—"Mr Adam in that passage refers to some steps which had been taken in Edinburgh with regard to the management of woodlands?" "Soon after the above meeting the Arboretum was sanctioned by the Town Council, and 9000 young trees were planted adjoining the Botanic Garden. Since then we have had the Forestry Exhibition, and derived therefrom the rudiments of a museum and library; what we want now to make a good beginning is a lectureship, or chair of teaching; without that we cannot go much further."—"You have been summoned before this Committee at a very short notice, and, I am afraid, at some personal inconvenience. I would not, therefore, ask you for any exact expression of opinion as to any precise steps to be taken, if you would prefer to defer that to any future opportunity?" "I only came yesterday from St Andrews, at a day's notice."—"The general sense of your evidence is that the establishment of a forest school would, in your opinion, be extremely beneficial to our English woodlands?" "Yes, to all grades of foresters, and to the forests." . . .

"You are aware, are you not, that these countries, Great Britain and Ireland, stand in relation to most of the countries of Europe in a very backward condition as to forestry?" "As regards systematic planting, with a view to the production of wood, they do; as regards true sylviculture, we are in a very backward state."—"But also as to the extent of acreage under forest, are we not in a very backward condition?" "Certainly we are."—"Do you not think that, commercially, the state of forestry in these countries is a matter of serious consideration for the empire?" "I think immense benefit would result, both economically and otherwise, from a more systematic management of our woods, and the skilled training of wood managers and subordinates."—"With a view, as one of its main objects, to the extension of the forestry system in this kingdom; is not that so?" "Certainly."—"You are aware that the acreage under forest in the United Kingdom is excessively small as compared to that in France, in Germany, and most of the other countries of Europe?" "That is the case."—"So that, as compared to the great forests that you know so well, the forests of India, it might almost be said that we are in a very bare state in this country?" "Very much so."

"Do you think that the institution of a forestry school in this country would be of very material consequence to the empire at large?" "Without a Forest School I do not see how we are to make any further progress; it is of immense consequence."—"There has been considerable movement towards the establishment of a School of Forestry in Scotland, has there not?" "Various steps have been taken, which I have already alluded to. We have the Arboretum attached to the Edinburgh Botanic Garden, and we have the beginning of a museum and a library, and we want now a curriculum or chair of forestry for teaching."—"You want a systematic plan of teaching forestry in Scotland?" "We are endeavouring to apply the small surplus of the late Forestry Exhibition in that direction. The Marquis of Lothian has sent out a circular, and some £800 or £900 have come in towards that purpose; but we want £10,000 to found a Chair."—"But besides establishing a forestry school in Edinburgh, would you not also think it very desirable that there should be a forestry school in this country?" "I think there should be one in Scotland, one in England, and one in Ireland."—"But in England?" "Certainly."—"You think it very desirable that there should be a forestry school in England embracing a class of

foresters for the service of this country, independently of those who are educated at Cooper's Hill for the Indian service?" "Certainly."—"Are you aware that forestry schools have existed on the Continent of Europe for a very considerable time. There are, at present, nine such establishments in the German Empire—viz., two in Prussia, one each in Bavaria, Saxony, Wurtemburg, Baden, Hesse-Darmstadt, Brunswick, and Saxe-Weimar. Therefore you would not think it at all excessive that there should be a forest school established in Edinburgh, and one established in London, irrespective of the Cooper's Hill school?" "Most certainly not excessive."—"Are you also aware that schools of forestry have been established in the United States of America?" "Yes, and I have seen schools in France, Germany, and Italy."—"You have seen the schools I have named just now, perhaps?" "I have seen the school near Dresden, in Germany; the school at Nancy, in France; and the school at Vallombrosa, in Italy."—"Are you aware that a very careful and elaborate system of education is carried out in those schools?" "Yes."—"I would just like to read for you briefly some of the principal points of education in the great school of Lystadt, Eberswald; do you know it?" "I know of it."—"It includes the cultivation of forests, forest improvements, and all similar matters which are necessary for the practical instruction of the pupils, and a very elaborate system of scientific education is conducted in preparatory courses for the training of the pupils in the highest possible way?" "Yes, I am aware that it is so."

"You are aware that in this country there is a very large consumption of timber, are you not?" "Very large indeed; there is no country relatively where it is more so."—"Did you happen to see the statistics furnished on this subject by Mr Simmonds?" "I did; I have seen the paper read before the Society of Arts."—"With your knowledge of England and Scotland, and what you know of Ireland, do not you think that with the assistance of a forestry school to propagate correct ideas throughout the country, a very material proportion of the supply of timber requisite for industries in this country could, after no very long time, be supplied from the home-grown plantations?" "I think it would be very important. It is difficult to forecast what proportion we might be able to supply, but we might do a great deal more than we do at present to supply the needs of the country."—"What we do at present is comparatively little?" "Yes, it is comparatively little."—"And you do think, I believe, that in a comparatively

short time a very considerable addition in the way of home-grown timber and forest products could be made to the general supply on which the country is dependent at present?" "Yes; forest produce might be utilised, and a better scantling of timber might be grown by careful management, and many things turned to account which are already so much used in Germany."

"Do you think that this country, by which I mean the three kingdoms, England, Ireland, and Scotland, can hope to depend much or at all in the future commercially upon the Indian supply, having regard to the great distances, the cost of carriage, and so forth; would you suppose that, from the vast areas of forests in India, any practical commercial supply could be obtained for this country?" "No, I think not; there are very few woods now exported; teak wood is the great commercial wood of India, and those which are sold by weight, such as sandal-wood, box-wood, &c."—"Teak-wood is of exceptional value in the timber trade, is it not." "It stands quite alone for shipbuilding."—"But the purposes for which it is used are comparatively limited?" "They are comparatively limited at present."—"And you do not think any considerable commercial supply could ever be hoped for from any such distance as India?" "Only teak-wood, box, and fancy woods."—"Those which are used for a very limited purpose?" "Which are of great value for a special purpose." . . .

"With regard to Canada, are you aware that the great supplies that we draw from in Canada are being very seriously diminished?" "I have not myself seen it, but there can be no doubt of the fact from what we read."—"Perhaps you saw the report recently procured through the kindness of the Marquis of Lansdowne, wherein it is shown that the province of Prince Edward's Island, which was once very richly wooded, is now totally denuded of timber; the Lieutenant-Governor reports that there is no longer any timber to export there, that it has all gone down under the clearances by lumbermen, and the general traffic in timber?" "I believe that is so."—"Do you think this country can depend in the future, as she has done in the past, upon her supplies from abroad with the same certainty as was formerly the case?" "There is no doubt that the supplies are rapidly diminishing in many countries; there can be no doubt whatever of that."—"Does not it then become a very serious question for this country, that we should take thought to supply by some production, as far as we can, timber to supplement the shortcomings of those countries upon which we have been

hitherto dependent for supply?" "I think it is of great consequence that we should increase the production in our own country, and do as much as we can to meet its wants."

"Have you directed your attention to considering what area of land for the growth of timber could be fairly supplied in England itself, in Scotland, in Wales, and in Ireland?" "I could scarcely venture to state the figures of the available area from memory. There is a very great extent of land available for planting, no doubt, in Scotland and in Ireland."—"Is there not also a very considerable part of England itself now lying comparatively unproductive, which would grow timber better than anything else that could be suggested?" "Yes, on the banks of navigable rivers, and in favourable positions, it is very desirable. In other places it might be difficult to make it financially successful; but where there are navigable rivers, and special advantages of carriage, it is very desirable to turn them to account."—"Are there not great tracts in Cumberland, in Westmoreland, and Northumberland which would naturally invite plantation as a suitable thing whereby to occupy them?" "I believe there are. I am not specially cognisant of those counties."—"I do not suppose you have specially turned your attention to that; I merely want to know whether you do not think, as the result of your observations elsewhere, that those great stretches of land in Wales, as well as in the north of England, would afford very suitable places for re-afforesting?" "I believe there are very extensive tracts which might be utilised."

"You know Scotland very well?" "Yes, I know Scotland very well."—"May I ask you with regard to Scotland, do you consider that a greater area than the three-quarter million acres, which is about the extent of the forests in Scotland at present, could be fairly devoted to the growth of timber, as on mountain slopes or other situations which are not very profitably occupied at present?" "I think there are sub-alpine districts in the Highlands very suitable for planting, and a very great extent of area which might be planted. I am familiar with Perthshire and Inverness-shire, and with places in the west of Scotland where trees grow very well. Upon the east coast they do not grow so well, being exposed to the east wind. But there are very great extents in those Highland counties which might be turned to good account; especially towards the seaboard of the west coast they would grow very well, and in the midlands of Scotland also."—"You know some parts of the

north of England pretty well, do you not?" "Yes."—"Are there not great slopes of land, that are now comparatively idle, which would afford suitable situations for growing timber upon a large scale?" "I believe so."

"May I ask if you know or are familiar with the rules laid down by scientific foresters of very great experience in all countries as to the extent of land which ought to be in any country under timber, in order to afford the requisite protection of all kinds—shelter, water supply, and so forth—to the rest of the country?" "That would vary in different situations, and under different circumstances. The need for shelter, for example. In India we are in the habit of reserving the forest on the upper third of the mountains; that is to say upon the crest, for rainfall and other purposes. Narrow belts would not succeed financially where there is a great extent of fencing. Square blocks and plantations upon the banks of navigable rivers would financially answer very much better."—"Is there not a general consensus amongst the chief forest authorities in Europe and America, where the subject has been very closely studied within the last fifty years, that from a fifth to a fourth of the country ought to be under forest, for the realisation of the best conditions for the rest of the country?" "Yes, it is so stated as necessary to keep up the natural equilibrium."—"You would, then, say that that might be taken now as a pretty well established law, in which the great forest authorities are well agreed, that from a fifth to a fourth of any country should be covered in timber in order to protect the rest?" "I understand that that is the opinion of many persons of sound judgment and reliability."—"May I ask you now, after a lifetime devoted with great success to the cultivation of forests, whether you do not concur in that view?" "I think it is reasonable, and I concur in it as a general rule. There are certain districts and places to which you could not make the same rule apply always, but I think it might be admitted as a reasonable proportion."

"Is it not also generally understood that, under the process of denudation of the land, the waste of the nutrient soil is constantly going on where the country is not protected by forests?" "The effects of denudation, both in Eastern and European countries, are very serious."—"Is it consistent with your own observation that denudation has been going on in England, as well as in Scotland, Wales, and Ireland, to a very large extent, since this country was disafforested two or three centuries since?" "I have been very

much struck with it in other countries, such as Spain and Italy. In Eastern countries also the effects of denudation are most serious; but in this country there is so much ornamental and other wood that I could not use the same language with respect to it as I do with respect to other countries."—"But including even the ornamental wood, and giving credit to it to the largest extent, is it not the fact that the total area under wood of any kind, ornamental or otherwise, is comparatively small in England?" "It is comparatively small."—"I suppose you have sometimes consulted the Agricultural Statistics of England, a very valuable work published annually?" "I have."—"Is it not stated there (special attention having been devoted to the matter since this question has come to the front so much in recent years) that the quantity of timber standing in England is comparatively small? The total amount, as returned in the Agricultural Statistics for England, is only 1,466,038 acres. Now, just for the purpose of furnishing a comparison, I may state that in France the amount under timber is 22,000,000 acres; the amount in Austria proper is 23,000,000 acres; the amount in Hungary is 22,000,000 acres, and so on. In the grazing lands of England 761,892 acres of timber are returned, and in the corn counties 704,146, which makes the total I have just cited for England at 1,466,000; which, taken in comparison with the 22,000,000 in France, 23,000,000 in Austria, and 22,000,000 acres in Hungary, leaves a very beggarly result for this country?" "Relatively it seems certainly a very small proportion."—"Scotland is returned for 750,000 acres, which is at or about the amount, is it not?" "It is; it is not much more at all events."—"Ireland is returned for 350,000 acres, which is 45,000 acres less than that country had in the year 1841?" "If so, that is a very grave matter."—"Is it not also consistent with your knowledge that a very considerable amount of cutting of timber is going on in England, Wales, and Ireland, without any attempt at reproduction of timber?" "I believe it is so in certain districts."—"Therefore we may say that, with a steadily increasing annual demand for timber, which is constantly rising all over the country, the amount of timber in England, Wales, and Ireland is steadily, and I might even say rapidly, diminishing?" "It certainly is rapidly diminishing."

"You in Scotland have paid in the last century very great attention to the cultivation of woods, and you stand for the last 25, or perhaps 40 or 50, years at about 700,000 acres; something has

been added recently, but I take the official statistics as representing about three-quarters of a million acres. Now, in the face of that state of things, do not you think it a matter of State importance that the question of supplying by reafforesting certain appropriate parts of the country should be seriously taken up?" "I think that the replanting of naked districts would be highly beneficial. In Scotland the Arboricultural Society has existed for 31 years, and we are paying great attention to that point; that the afforesting of naked tracts would be highly advantageous in a climatic and economic point of view, there can be no doubt."—"Then, besides the timber, which is so directly important and necessary in architecture and domestic dwellings, furniture, handicrafts, and manufacture of almost every conceivable kind, is there not a very considerable number of industries mainly dependent upon forest products, such as bark, tar, resin, turpentine, and so on?" "Yes." "As to bark, and the undergrowth in woods near large towns, would not the production of all those materials give rise to very important industries in those countries?" "Yes, I think a great deal more could be done than there is done. One of the several premiums offered by the Highland and Agricultural Society, is how to utilise those waste products; there is a deal of material burnt which might be turned to account. In Germany nothing is lost."

"Is not there a very high value, even yet, given to iron which is prepared by timber smelting?" "Yes."—"Are you aware that in the Cumberland district the smelting of iron by timber is still carried on very extensively, resulting in the production of a very superior class of iron and steel for instruments in use in surgery and in the arts?" "I have no personal knowledge of the Cumberland iron works; but I have seen a great deal in the coniferous forests in the Himalayas of iron smelting by timber; it requires very good management, otherwise it consumes a great deal of wood."—"Are you aware that charcoal-smelted iron stands very high for the production of the best quality of steel?" "Certainly." . . .

"Then you think there is a considerable field for the operations of reafforesting in this country with every prospect of success?" "I think there are many places exceedingly suitable for planting."—"I understand you to say that you would like to see a separate school of forestry in each of the three kingdoms?" "I hope eventually that may be so."—"What I want to ask you is, whether you do not think it would be much the better course to attempt to get one school in the largest of the three kingdoms at first, and

not to attempt at first to get three schools?" "Yes, but I recommend that being done eventually."—"You think that it would be better to try and get one good school, with as much opportunity of practical experience as you can, and when you got that school full to perhaps try some other; but you would not think of trying to start three schools at once?" "No; the only institution at this moment which gives certificates in forestry is the Highland and Agricultural Society. We have students from Cirencester, from Downton, and from Glasnevin examined there. There are not many candidates, but a beginning has been made, and I should like to see progress, and to have other places ultimately."

"In your visits to those large forests in Scotland, would you describe what opinion you formed regarding the management of the works?" "I think there are some very good men, shrewd, practical, intelligent men. They have not had the training such as our men receive on the Continent. They have not been taught inorganic chemistry or vegetable physiology; but for practical work, that is to say, converting timber and forming plantations, they are very good men. We have had three or four of them in India for doing certain work, such as planting, and they did it very well. For example, Mr MacIvor, of the Cinchona plantations, and Mr Ferguson, of the Teak plantations, did their work very well, though they had not had a school to go to."—"They had practical and not theoretical knowledge?" "Yes."—"Would you consider that the result of their planting operations was successful as a whole?" "Some of them were very successful." (Mr MacCorquodale of Scone is a very good planter.)—"Do you think those woods would have been better if they had been planted by a highly trained man skilled in inorganic chemistry?" "I think that more produce might have been turned out in many places. There are many things which have not been utilised as they might have been, but there are some exceedingly shrewd and valuable men concerned in the work."—"Then you think that, on the whole, those forests might have been better if they had been planted by men having more theoretical knowledge?" "Yes; but they are exceedingly good planters."—"If they had had a little more theoretical knowledge, they could have turned their practical sagacity to better account?" "I think so, for many of them do wish they had had that. They have read what books they have been able to get in their cottages, but having had no Forest School to go to, lacked opportunity of improvement."

"Do you think that the school of forestry might be made self-sup-

porting?" "I think that would be a difficult question to determine; it is difficult to predicate what the number of students would be who would attend the school. The class of agriculture in Edinburgh varies from 20 to 40, and we should have reason to hope for at least an equal number."—"What class of people would attend the arboricultural classes in Edinburgh?" "Those who are looking forward to being estate agents, factors, nurserymen, and such like." —"Is not there a great difficulty in Scotland that many of them could not afford to pay the price for the forestry course?" "That is a question which I could not answer without more consideration." —"Supposing I pay my forester £50 or £60 a year, he is not in a position to go through a very expensive course of education?" "No; but he might have had 18 months or two years' training with great advantage: he need not have been there all the year; he might have been there half a year for two years. To obtain those certificates of forestry which are granted by the Highland and Agricultural Society, we find that two seasons are generally sufficient. That is the beginning of what I would like to see."— "I think you were already asked about the advisability of planting more extensively in Scotland on the mountain slopes and places of that kind; but is not there the difficulty that many of those places are very inaccessible to railway communication?" "Wherever they are inaccessible I would hardly advise their being planted; I would say, generally, that near navigable rivers, and wherever you could get the timber out, it would re-pay its expenses."—"Do you think that the planting would pay as well as grouse moors or deer forests?" "That is rather a difficult question to answer at present."—"If you planted great tracts of forest land you would exclude sheep, and you take away from the food supply of the country?" "You do not require to exclude sheep everywhere after a certain time, and the grazing would improve."

"How many years do you think you would have to exclude sheep?" "Perhaps thirty years."

"Thirty years out of how many?" "After thirty years you might let the sheep in—that is, till the trees approached maturity. I am not speaking exactly, but somewhat in approximation."

"Is it not the case that after a fir wood has grown up to a certain height there is very little undergrowth?" "The undergrowth dies away after a certain time; it depends upon the light and shade. The German forests are usually darker than the British ones; a German forester always looks up to see what quantity of light

comes in."—"If we grew a much greater area of wood in Scotland, and a great quantity of wood were cut down every year, would not that lower the price of wood very much?" "That would somewhat depend upon the foreign supplies coming in; the price is low at present."—"Does not it happen that when we have great gales in Scotland, and a number of trees are blown down, they become unsaleable?" "They should be properly thinned, and then they would be less liable to be blown down."

"With regard to sheep, M. Boppè expressed the opinion that the forests would rather increase the quantity of sheep-feed than keep it down. He said it was quite true that you would have to exclude the sheep and cattle for thirty years out of, say, a hundred; but he said that afterwards the keep of the sheep under the trees would be much better than on the moorlands where it at present exists. So that, though you would exclude the sheep for a certain number of years, there would subsequently be more grazing for the sheep than there is at present on the land that is not now afforested?" "Yes; I presume he was speaking of deciduous trees, oak and such like, and not of fir trees." . . .

Colonel George Pearson, late of the India Forest Department, and for eleven years in charge of the students attending the Forest School at Nancy, France, in training for the India Forest Service, was the next witness, and in the course of his examination replied as follows:—

"Do you generally concur with the evidence which has just been given by Dr Cleghorn?" "Generally, I do; there are some little explanations I might give if I were asked as to details."—"But, generally, you take the same view as Dr Cleghorn does?" "I do."—"You are strongly of opinion, I presume, that the more scientific training of the Indian forest officers has had a good effect in raising the Indian forest revenue?" "Without doubt it has had a good effect upon the management of Indian forests since I was first connected with them, twenty-five years ago."—"Do you think that if our forest officials in this country were more systematically trained we might hope for a somewhat similar improvement in this country also?" "Undoubtedly it would be of the greatest possible advantage, both for the land agents who have the management of the property, and also for the subordinate officers who have the actual management of the woods. I think both of them want instruction."—"Have you formed that opinion from your own observation of the

general condition of the woodlands?" "Undoubtedly; I had the advantage of going through our forests with the French professors. I had orders from the India Office to conduct them round, and I had letters to the principal landowners in Scotland; so that I had ample opportunity of learning the state of the forests there, and also of the Crown forests in England."

"I believe in France they are strongly of opinion that it is undesirable to plant oak by itself, and that it does better with beech?" "There are not above two or three forests in France in which the soil is capable of growing oak, pure; and this is the case, not only in France, but in Germany, and in the Vosges forests, which I am acquainted with."—"I believe it is the case in this country, that we sometimes see oak by itself, and sometimes with larch, and sometimes with chestnut?" "Yes; they thought in this country that it was impossible to have too much of a good thing, and therefore they planted the oak alone."—"I suppose you would say it makes a great difference in the ultimate outcome of forests what species of trees are in association?" "There can be no doubt about it."—"I believe you agree with M. Boppè in thinking that in the New Forest a large area is going to wreck and ruin, and will ultimately go to waste?" "Undoubtedly it is degrading, as we call it in France; you can see that from the invasion of the heather, which is creeping on in every direction in the New Forest."

"I believe you have been several times applied to on behalf of the English Colonies to recommend officials to them to take the management of forests?" "Yes,"—"Have you been able to supply them with competent officials?" "Yes; I could have recommended very clever officers, but they could not be spared at the time. I was able, however, to find some French officers to do what was required."—"You were unable to find any qualified Englishmen; therefore you were obliged to recommend French officials for the purpose?" "Quite so."

"With regard to the French school, I believe you are of opinion that the French School is a very admirable one, but that there are several reasons why it is not altogether adapted for English students. For instance, the loss of time involved in the use of a foreign language, the difference of the technical terms in England and France; and then, again, the political difficulties which sometimes arise, which have in one case, at any rate, produced very serious inconvenience; and also that it is undesirable to create an exclusive service for India with our own forest officials; and lastly,

that it is undesirable to send the Indian pupils abroad, because that renders it more difficult to establish a forest school in this country: I think you have indicated elsewhere that those, to your mind, were objections to sending pupils to Nancy?" "I think those are the principal reasons. I think, at the same time, that the school is an admirable one, and has done great service."—"Of course, it would be practically impossible to send those who are to take the management of English woods, and particularly those of the lower grade, to a foreign school?" "It is much too expensive. The remuneration which an English forester gets is so low that he could not possibly afford that education in France. It is rather an expensive school and rather an exclusive school, and that is one reason why it has been so much attacked in France; it was not intended for the class of men who chiefly want that education in Great Britain."

"With regard to the proposed arrangement at Cooper's Hill, do you consider that would meet the requirements of English landed proprietors in the way of supplying them with trained forest officials?" "No, I do not think it would be suited to the requirements of the country; it would answer very well for the Indian Government, but the education at Cooper's Hill is much too expensive even for the requirements of a land agent's education."—"You think the arrangement may be very well suited for the requirements of the Indian Forest Service, but would not assist much in the preparation of English forest officials?" "Quite so. I do not think it would affect the question of English foresters at all."—"You would consider that a certain amount of technical training would be very valuable, not only for the head officials, but also for the persons of a lower grade, such as woodreeves, and bailiffs, and managers of small woodlands?" "I think that, if possible, any education that was given in England ought to be made sufficiently economical to enable the class of wood managers and wood bailiffs to, at all events, participate in a portion of the lectures, which they might do. It would not be necessary for them to follow the higher course of study which one would wish a land agent to follow, but I should try to make the education such that there might be a portion of the course that would be suitable to every one without any undue expense; that, I think, we ought very carefully to keep in view."—"Supposing the case of a man who has the management of 500 or 1000 acres of land: it would hardly pay to give him a large salary, but still he would benefit by eighteen months' or two years' training

in the forest school?" "Even if he got three or four months in two years mixed up with the rest of his education, it would be very valuable to him."—"He would be worth £30 or £40 a year more than he would otherwise?" "Yes, obviously."

"I know you have had a great opportunity of considering the subject, and if you would like to make any suggestions as to the management of our woodlands, the Committee would be very glad to hear you?" "Two years ago I gave a great deal of attention to the subject, when I was occupied under the India Office with Dr Brandis, and we then submitted two schemes for their consideration. My opinion is clear that we ought to utilise in some sort of way the existing means in the country of giving a general education, and to supplement that by giving a special forest education in some convenient place, where there should be a museum supplied with an instructor in forestry, who might give lectures on the subject, and conduct the pupils from time to time into different forests which he might select, with the view of explaining on the ground the teaching which he had given them in the lecture-room. Further, I think there ought to be some lectures on what I think is called physical botany, and especially that class of botany which refers to the growth of trees and the different natures of the different trees. I would put the school in the most central place I could find. I have been to Edinburgh, and I have also visited the South Kensington establishment in London. King's College and University College seem both to me to grant facilities for general education. You might have your examinations, say, in different standards for different certificates. In the higher class, we will say, the land agents who would be in charge of large properties might attend a larger scheme of lectures, and the woodreeves and wood bailiffs might attend only the elementary lectures, say, upon physical botany and wood management. What is wanted in England is to teach the management of forests in an economical way. Then I would have a series of examinations granting certificates to those passing them."

"Would your idea be to have a course of either two years or three years, say two years, in the lower grades, and in the third year a course of instruction up to a higher standard?" "Quite so; but I think the lower grades need not be occupied entirely with the two years' course. You might arrange the course of the lectures so that if you gave lectures on physiology, biology, and so on, at South Kensington, they would not be required for the lower class of men. These might only attend for the

course of forestry, forest management, elementary botany, perhaps, and so on, so that they need not spend their whole time in forest education, but might be carrying on their other education at the same time."—"Then it might be arranged that the instruction should be given at a particular period of the year, so that people engaged in the management of woodlands might come up at a particular period of the year, as they do in Scotland?" "I think you might supplement the system as much as possible; I think, from inquiries I made as to the means of education at the disposal of the people, both in Edinburgh and London, that they are sufficient to afford the means of giving a forest education, if this special instruction be added."—"I suppose it would be necessary in the case of any forest school, that you should have the opportunity of sending the students into woodlands to see the practical management on the spot, would it not?" "It would be absolutely necessary. Even as regards the growth of trees, if you tell a man that the oak will not grow alone, it is no use telling him so in the lecture-room, unless you take him out in the forest and show him where it is not succeeding by itself, and where it is succeeding with other trees."—"It would not be possible to leave it altogether to private enterprise; because it would be necessary to have access to woodlands of some extent?" "It would be absolutely necessary to have access to large woodlands."—"Do you think that even if no assistance were asked for from Government, it would be desirable that Government lands should be rendered available for the teaching of students in forest schools?" "Certainly, and I believe many of our private owners would open their lands willingly to the pupils. From my personal inquiries, I might say that there would be no difficulty in getting access for the pupils to the different forests."—"You think, as I gather from you, that a person who would be receiving £50 or £60 a year without any training might, after a year or two's training, be worth a good deal more?" "He might be worth double his present salary." . . .

"You want men for the forest service of a superior class of general education, do you not, for the superior officers?" "No; speaking of the English forests, I do not think they are any of them of sufficient extent to allow for the salaries of highly paid men, and therefore you could not have them alone. But my view is that means should be put at the disposal of people who will become land agents to obtain a knowledge of forestry; then they would be able to control their wood bailiffs; and I would at the

same time give the wood bailiffs and managers a better education, so as to enable them to carry on their operations in a more intelligent manner than they do. But I do not think you could have a class of foresters in the same way as they do in Germany, where there are very large tracts to be managed, and where men make a profession of it entirely; I do not think you would get a very highly trained man to make a profession of forestry in England."

"Suppose you took the class of young men who would spend two or three or four years in a university, and who had acquired the principal portion of their scientific education, and you opened a forestry school, and put any examination that is thought desirable to mark the stage of education they had arrived at on entrance. Supposing them to be in a position to pass that examination in mathematics, and so on, what time do you think it would then take to put them through a course of forest education, specially; would you say one year or two years?" "If they had had a thoroughly good education before, one year would be enough; if they were carrying on their other scientific education, which I think would be the best way, concurrently, then two years. In France a young man attending the Forest School at Nancy has to take his degree before he can compete; either he must be *bachelier ès sciences*, or else he must have passed through the Polytechnic School; that at once involves a considerable amount of scientific education. Then he has two years in the forestry school. But a man in the school at Nancy continues his applied mathematics; he continues his instruction in surveying, road making, machinery, certain elements of chemistry, minerals, and geology. If he is carrying on that concurrently, it would take two years, and I think that is the best way of teaching, because you could hardly spend the whole of your time in teaching a man forestry, else the whole of the forestry education could be done in one year. The more extended period also gives a better opportunity of taking the pupils into the forests at different times of the year; that is to say, by spreading it over two years; so that I think it should go on concurrently with his other education."—"You would say, taking a somewhat superior classman from the university or a public school, and submitting him to such examinations as might be thought necessary to test the amount of education he had already got, that in two years subsequently to that you could fit him with a sufficient knowledge of forestry to make him a useful servant of the State for carrying out any forestry operations that would be

attempted in this country?" "Certainly; there are a good many of the German forest schools affiliated with the universities where the course is four years. Take Carlsruhe and Tubingen, in those cases there are three forest professors only who give lectures on forestry and forest management and botany, and then all the rest of the course is going on concurrently with the regular course in the university. It is only a portion of the time which is devoted to forestry instruction, and the rest of it is going on in the ordinary way. I think that is the best way of teaching them."—"In the first instance, you would probably have to deal with a class of young men who would be going to superior schools or universities up to, say, their second year, taking them and submitting them to such an examination as you think necessary. Do you think that with such a special education in forestry of two years you would at the end of that time be able to turn them out fitted for the service of the State in this country for forest operations?" "Quite so; they are very well taught in two years in Nancy. At Nancy they take sylviculture the first year; that is to say, the growth of trees and the physical conditions of their growth. The second year they take *aménagement*, which is the management of forests and their economical treatment, felling, and management with regard to the production of a proper amount of revenue; the two things are distinct; they teach one thing the first year, and the other the second year."—"In addition to the system of forest school education, would it not be very desirable that something in the nature of forestry education should be added on to the curriculum of some of our universities, following the example which is set in some of the universities on the Continent?" "I thought I said a little while ago that I did not think Oxford or Cambridge were suited to it, but I said that I should utilise the University College and King's College for the purpose, a forestry course being added on to the education given there."—"But for an expenditure, which you put at about £600 a year, there should be no insuperable difficulty in setting up at least one forest school in this country to begin with?" "Certainly not; I think the first thing would be to get a building, for we could then appoint the officers, and let them make a forest museum and the things that are necessary. Then I would set them to give lectures, and to that I would, if possible, superadd some lectures in what is called physical botany; that is a necessary part of the forest education."

Have you sufficient knowledge of the existing woods in England

or Scotland to say whether it would not be possible to carry out a course of practical instruction in some of these forests without having recourse to the French schools, against which exists the difficulty you have already mentioned, of the want of knowledge of the language?" "The only difficulty is that the English and Scottish forests are so young. I do not know myself one mature forest at the present time in England or Scotland. There is no doubt that a great part of the instruction might be carried out in the English and Scottish forests; but besides the growth of trees, there is one very important part of the instruction—namely, the removal of the crop—which you cannot do at home, because the forests are not matured; you cannot get that without going abroad for a certain time. You would not have to take much of a tour, but if you want to teach young men what concerns the removal of the timber, that cannot be done in this country, because it is not ripe."—"You mean a proper system of laying out a forest, so as to cut it in certain proportions?" "Yes; removal with a view to reproduction, which should be natural, no doubt; because after you have once established a forest, you should never require to plant it again."—"I suppose there is no forest in this country where they have adopted the block system of felling and management, or the French system known as *tire et aire?*" "I saw a very good natural reproduction of larch in the Earl of Seafield's forests, which showed me that it could be done, and also of Scots fir at Lord Lovat's, whose wood manager, Mr Dewar, is a very intelligent man."—"Still, on the whole, it is substantially true that there is no scientific laying out of forests in England as on the Continent, with the view of cutting them down in successive crops?" "Certainly not. I think Mr Dewar mentioned that Lord Lovat had instituted the system which we have on the Continent, which, however, was very much interfered with by the deer forests; but still the thing is more or less done on correct principles. He told me that the late Lord Lovat had instituted that system himself, and I have no doubt he had seen it on the Continent."—"But a deer forest has not necessarily a stick of timber in it?" "No. I said it was very much interfered with by the deer forest, because Mr Dewar told us that he could only go into the forest five months in the year, and those were the months when it was least desirable he should be there; but that at the time when he wanted most to be there, he was prevented by the lease of the shooting from going in, the forest being leased to an American gentleman."—

"Are we to understand that you would think it absolutely necessary, in order to train men to this system of cutting and removing the timber, that they should visit at stated periods of the year some of the great French or German forests?" "To get complete instruction, yes; but they might learn a lot of useful knowledge without going there."

"Do you attach very great importance to the establishment of a forest school in this country, having regard to the state of our forests?" "Certainly. If possible it ought to supply a kind of education which would reach as low as possible; that is to say, as low a class of officials as possible, so that the wood managers and the smallest paid men should be able to attend. I think that is very important. Perhaps I might be allowed to add that there are a number of bodies who are interested in the instruction and education of land agents, and I think it would be a great thing to interest them in the question also. At present the Surveyor's Institution, I believe, does something in the way of instructing its pupils in forestry, and if they were interested in the question of education, they would probably bring their pupils to the school and send them through it."—"Are there not in a great many of the Scottish forests young foresters very well practically instructed in the management of timber for commercial purposes?" "If you were to say practically very well instructed, I should say not; but there are many of them exceedingly intelligent men, who, by rule of thumb and by the experience which has been handed down to them, have learned the system of planting and growing trees exceedingly well. And that I think was also the impression of the French foresters who came over with me, that in those respects they had nothing very much to teach them, and certainly it was of myself. But there are points on which knowledge is required. In one forest, in which a great number of trees were blown down (we saw a great number on the ground), we were certainly of opinion that the damage might have been saved by a fringe of birch, which would have grown perfectly well above the Scots fir. They ought to have been planted to keep the wind out of the ravines, but instead of that they planted Scots fir right up the top of the ravines, the wind got amongst them, and knocked them down like a field of corn."—"Like spillikins, as a Scottish proprietor described it to me?" "Yes, we certainly thought that a fringe of birch would have grown perfectly well at the top of the hill, and if it had been planted above the Scots fir, it would have kept the wind

out of the fir, so that a little scientific training would have saved a great deal of loss."—"Does not the system of planting wind-breaks, as they are called in America, where they run sometimes 100 miles or more, require a considerable knowledge of something more than the mere growing of trees?" "I can speak of a forest of larch, which is very near the place where I live, in Radnorshire; a magnificent forest, which has succeeded in every way. Seeing that was so successful, the late owner planted the opposite side of the hill with larch too, and that has been an entire failure. I took one of the French professors over with me last year, and we at once came to the conclusion that the first forest was planted in a proper 'exposition,' as we call it, that is, suitable to the growth of the larch, whereas the other was not, because one was dying away, though it was not attacked by disease, while the other was doing perfectly well." . . .

"Do you think a practical course of two or three months might be advantageous to those who are not rich [such as the sons of foresters, farmers, ground-officers, and others], and could afford only a short space of time?" "I think a chair of forestry at the Edinburgh University, where many of those young men go, with a course of lectures of three months (because I do not think any man could give a course of lectures that would be any practical use at all under three months), would greatly meet the want. Part of this might be in the school and part education in the forest; I know that a good many of these young men, who are farmers' sons and the like, do go to Edinburgh and get an excellent education for a small sum; they might give a certain number of months of their time up to learning forestry, and the more the better, as the more knowledge they would be able to get the more capable men they would be. I think that would have the best possible effect in Scotland."—"Have you any great faith in teaching?" "Lectures in the school I have actually no faith in unless illustrated by practical instruction. If you tell a man in the lecture-room that such and such consequences will take place, and do not show him the consequences on the spot, he does not believe anything about it; it goes in at one ear and out at the other; he will think it all nonsense; but if you want to impress your teaching upon him you must take him out into the forest and show him the operations of nature."—"He would have to plant trees, I suppose?" "He would have to learn that under a wood manager; he would have to find time to dovetail that in, but it would not form part of the school instruction. In

the forest schools I would teach all the principles upon which trees grow and are produced, and the principles of germination of the seed."—"Would you think that the course of education indicated by my honourable friend the member for Dublin County [Dr Lyons], was a little too ambitious in its scope? What the honourable member suggests is very excellent; it is perfectly right in theory, but in practice would you get the men to come to you?" "I think you would get more pupils under your system than you would under his, but I do not know why you should offer a low system of education. I would raise my standard of education as high as possible; that is to say, I would have the lectures so arranged that the pupils who commence, we will say, and proceed up to a certain point should profit according to their wants equally as those who carried on their studies further."—"But you will not get university men to come to the school and go through this course of training, unless there is some inducement held out: what occupation would these men get afterwards?" "They might go to the Indian forests if the Indian forests were open to them; or they might go to the colonial forests, where, undoubtedly, there will be a demand now in due course."—"But with regard to the English woods?" "The higher educated men would not easily find remunerative employment in English woods."—"What we want would be practical foresters, whom you would pay at the rate of £100 a year or so?" "The practical education you would want for that man would be the same as for the higher man; but you would carry on their education to the point only to which it suited them to go, and to which they could afford to go." . . .

"The class of men who would be educated in such a school of forestry as you speak of would be able to earn a fair living, would they not, as travelling foresters, going about and giving directions, and laying out, as a sort of advanced landscape gardener?" "As advisers I think the superior class of men might. My idea would be to make the education accessible to all; I would have a course of lectures which would commence from the beginning, from simple subjects and with simple experiments, going on to higher subjects such as Dr Lyons keeps in view. If you pay a man, you may just as well keep him at work. I would first give an elementary course, then a more advanced course, and then a little more advanced course still; the wood manager would attend the first, the land agent the second, and the man who wanted a thorough education would attend the three terms, or something of that kind. In that

way I think you might try to suit it to all; but I think it must be made cheap enough, and the means made accessible to the lower class of wood manager, as well as to the higher, if you want a practical result."—"But we were talking of the possibility of such a school paying, and the class of students that would go there; you were only asked with regard to agents who would want such a study as a part of their agency business, and also with regard to the lower class of foresters who would not be able to afford to pay the higher fees; but do not you think there would be a class of men who would take up forestry as a profession altogether, as advisers to go about and examine woods? There would be many a man who has a good deal of wood, but who still does not keep a forester of his own, to whom such professional assistance would be valuable?" "I would make the education complete: but for that purpose you mention I think the men ought to go through the complete course; they ought to go to the Continent. I would not give them a first-class certificate without."

"In answer to an honourable Member, you said that the school might be applied to two or three classes of pupils, some of them gentlemen's sons and farmers' sons, with a view to their combining a knowledge of forestry with land agency, and then there would be labourers who would do the felling and the planting and the labouring work of the school?" "I would hardly include the labourers; I do not think those would want instruction—they generally do their work very well in most places. The three classes would be, first, wood managers or bailiffs, who would get from £60 to £70 a year; then there would be the land agent who directs them, and who it is most desirable should have a little knowledge, as he would be able to direct and advise what planting should be done, and what timber should be felled, and all that branch of work, which is often very much mismanaged. Then, finally, I would carry on the instruction so that you could have a higher class of men who could either act as agents in the Colonies or as advisers at home."—"We have had evidence to show that woodlands are very much mismanaged generally, and that they are intrusted to the class of woodmen?" "Yes, I have heard of that."—"Could not you make the schools available for the instruction of our woodmen, because there is no doubt that the management upon large estates must depend upon the managers, the wood-men, more or less?" "I would make the elementary instruction such that anybody who had a decent education could benefit by it; but, of course, such a man cannot be

a perfect forester, because he does not know a lot of things that scientific education alone can impart, and which it would be impossible for him to understand unless he had a scientific knowledge of a number of things which a man of that class would not know."—"I do not know whether you are aware that at the Agricultural College at Cirencester the higher class of pupils have labourers who attend them from time to time, and who go out afterwards as bailiffs, but who acquire a certain knowledge of farm management by being attached to the College, which enables them to get better places than that of mere bailiffs?" "Without saying anything about the school at Cirencester, which I have seen, that is quite the right principle to go on."—"So that a School of Forestry might be educating a certain number of men who are in the position of labourers, who, having obtained a superior knowledge of the best mode of managing woods, might ultimately go out as woodmen?" "No doubt. I would be in favour of making the education as comprehensive and bringing it down as low as possible."

"You think that if the Government would give facilities, the New Forest or the Forest of Dean would be good localities for affording instruction on the spot?" "There is one spot in the Forest of Dean which is especially suitable for instruction, and that is the High Meadow Woods. The only thing is that in the Forest of Dean you can show little or nothing as regards the management of conifers; both that and the New Forest are mainly leaf forests, and you would want to take a man into some forest where the larch is planted by itself, because that involves totally different requirements from the trees which you see in the Forest of Dean. Mr Symonds thought he could teach a good deal in Windsor about conifers, but when I was there I had not sufficient time to go into the question as to whether the plantations about the Windsor Forest are sufficiently varied, because it is a very important thing that the forest in which you give the instruction should be considerably varied. You require every variation of soil, climate, and exposure."—"But practically for the experimental works those two localities would afford a commencement?" "They would afford a certain field. It would be for the professor who had the instruction to give, to say what facilities he wanted; but I do not think, from what I saw myself in going round the English and Scottish forests, that there is the least indisposition on the part of many of the great owners of forest lands to allow pupils to be conducted through their woods. After all, the teaching is merely a question of example.

You want to show that the things which are taught in the lecture-room actually take place in the forest. It is no use to tell a man that beech makes a suitable nursery for oak, unless you show him under what conditions it is so, and what precautions must be taken when you mix beech with oak to keep the beech from getting above the oak, and so on."

Mr W. T. Thiselton Dyer, C.M.G., F.R.S., Assistant Director (now Director) of the Royal Gardens, Kew, was next called in, and, in the course of his examination, stated as follows :—

"You have paid great attention to the management of forests and woodlands?" "My attention has been drawn to the general subject of forestry from the fact that Kew performs to a large extent the part of a botanical authority to the Government, and a number of questions affecting botanical work of different kinds are referred to Kew, which it is my special business to attend to. Amongst these, of course, from time to time, are questions relating to forestry, and although I have not myself, like the last witness, Colonel Pearson, any practical knowledge of the management of forests, I have been compelled, of course, to look into the subject, but more especially with regard to the colonies rather than with regard to this country."

"Would you be prepared to state now to the Committee what you would yourself suggest in order to improve the present state of affairs, or if the Committee were to ask leave to sit during the next session would you prefer to wait till then to give us your views in any further detail as to what plan it would be advisable to adopt in this country?" "For my part I do not profess to have sufficient practical acquaintance with the details of the subject to be willing to undertake to elaborate a scheme; but the Committee has been so well supplied with technical advice from the evidence they have heard from Dr Cleghorn and Colonel Pearson, that I should only be too glad in any way I could to support their suggestions. But what strikes me is that the reasonable way to proceed, if it could be done, is to make the demand for India a kind of nucleus of a school, because that is a constant quantity; it must go on. We are practically going to undertake in this country the education of a number of foresters for India, and it appears to me to be a pity that where you have an inevitable centre of forest education you should not utilise it in the second place for the education of such gentlemen as wish to undertake colonial service; and thirdly, for

the instruction of land agents and persons competent to give advice as to our own woods."—"You think it would be regrettable if arrangements were made for the training of Indian officials which did not admit of other students obtaining access to the same school?" "It appears to me that it would be little short of monstrous. I can quite understand that upon administrative grounds what the Indian Government does is like the operations of a foreign country; the Government of India will educate those people at its own cost, and in a manner perfectly distinct from anything which the Imperial Government does; but that appears to be the only difficulty of a substantial character. I cannot conceive that any difficulty of administration could not be overcome, and that the appliances required for one thing would not be extended to the other."—"It would probably be of advantage to the Indian Government that the schools should be open to other students; it would diminish the expense for instance?" "Certainly, one would hope that they would have professors really competent to teach the most accurate kind of knowledge, and it would increase the interest of the professors to have a large class, rather than to be entrusted with the care of only a few men."—"The fees imposed in the Cooper's Hill School appear to be £180 a year; that might be quite reasonable under the conditions of the Indian forest service, but would you not consider it to be upon too high a scale for a general forest school?" "It strikes me as rather a high rate of expenditure; it amounts practically to the cost of a university education. There are many men who go to Oxford and Cambridge who do not spend more than that sum; that of course fixes it as an education of a costly kind."—"Speaking generally, your view is that the Indian school might be utilised as a nucleus of a forest school, and that its being thrown open to others upon the same conditions which would make it accessible to forest students, would be of advantage to the owners of woodlands generally; is that your impression?" "I think that can be hardly doubted; there might be a difficulty in mixing the two classes of students, but that might be met by taking the lower classes of men in short courses during the vacation."

"Your idea would be to make the school of forestry applicable to India and the colonies as well as to our own country?" "I should like to get all the fish possible into the net; and, if we had such a school, to make it as useful as possible. I think it is surprising, considering how large is the interest of the English race in

forestry, that, except in India, we have taken no kind of active interest in the subject; although we own more forests in the world than any other race, we are at present, except in the most piecemeal fashion, absolutely washing our hands of the whole business." —"Do you consider that if we had had a school of forestry in England, we should have been able to send foresters to Cyprus, and that by this time the replanting of Cyprus, which has been begun by the Government, would have been further advanced than it has been?" "It is difficult to say, because the gentlemen who have taken the work in hand have done their best."—"You think there would be no practical difficulty in making the school available both for British and colonial sylviculture?" "I think not, because there is no great mystery in sylviculture, but what you want is some one who has a sufficient amount of practical and scientific knowledge behind him to be able to say to a colony, 'You must not cut down the forest along that ridge, because if you do, you will dry up the water there and let in the hot wind.' The scientific forester sees things which other kinds of men do not see. And these matters are not scientific theories; they are based upon common sense, and consequently can be pointed out and explained in such a way to the colonial residents that they will agree when the thing is once explained to them. The colonists do not do these things out of innate wickedness, but because the thing has not been pointed out to them; they have often not been long resident in the country, and they do not know its local conditions; and when they find, as they have done in Natal, that the destruction of the forest alters the physical conditions of the colony, they want to know why they have not some one to teach them; they want persons who will advise them. The Government of South Australia got their forest officer from Canada (that is an instance of the condition to which the colonists have been reduced) to show them what to do."—"Suppose a school of forestry were established in England, what would you say would be the best locality to establish a school for sylviculture?" "It is rather difficult to say."—"Should you say Kew?" "There are some advantages at Kew; there is a great store of information there; but there is not a scrap of English woodland there."—"It is near Windsor?" "It is; but I am not sufficiently a practical forester myself to say how far the woods at Windsor would give the instruction needed. I should be rather disposed to place the school somewhere near the metropolis, because I am strongly inclined to think that the education of forest students

cannot be completely conducted in this country; it seems to me that the forests, especially in France, are so extremely instructive, that we shall be obliged to send the students over there for a country excursion for a few weeks; even with my own amateur knowledge I could see in the Vosges that a week spent there was worth a month of reading about it." . . .

Do not you think it very desirable that there should be a class of highly instructed foresters, be they many or few, trained in a college in this country; is not there an ample field, both at home and in the colonies, for employment for some men, at all events, of very superior education, as foresters?" "I should think so. With regard, for example, to a matter in which I think you [Dr Lyons] yourself are very much interested, namely, the development of forestry in Ireland; that would certainly require for its inception forest officials of a superior grade."—"I mean with regard to the general question of forestry in those countries. Supposing it should be hereafter the intention of the Government to adopt a system of extending the forests in this country; is not the laying out of a forest, as to the site on which it should be placed, the best mode of planting, and all that, a matter which requires a very superior class of education?" "It seems to me that the whole thing depends upon your having a competent man to direct it; if it is not done properly at the start, of course it never can possibly be successful." —"It is not a thing which could be safely entrusted to persons who are merely educated as solicitors in this country?" "That is exactly the fallacy that Mons. Broillard attacks. Every one thinks that forestry matters can be managed by the light of nature, whereas to get any successful results they require a very considerable amount of technical skill."—"There is no doubt that anybody desirous of attaining a high class of technical education should also have an opportunity of instruction in practical forestry?" "Yes, because you require continuous practical attention in forestry, and the minor persons are required to conduct and superintend the detailed operations upon which the continued success of the forest depends."

Mr Julian C. Rogers, Secretary to the Surveyors' Institution, was the last witness examined, and stated as follows:—

"You have given a very considerable amount of attention to the question of colonial timber, have you not?" "The question has come under my notice from time to time, and at one period I devoted a

considerable amount of time to it ; the result, I think, is before the Committee."—"This report, which is entitled 'Colonial Timber : An Analysis of Returns in reply to queries relating to Colonial Timber,' was prepared by you, was it not?" "Yes."—"It was presented to Parliament, and published as a Parliamentary Paper in the year 1878?" "It was."—"It goes over a long range of subjects, and includes returns relating to the principal colonies ; the West Indian Islands amongst others?" "It deals with the whole of the British dependencies, with the exception of India."—"So it may be taken that we have elsewhere with regard to India the supplements with regard to the other dependencies of the Crown?" "That is so ; it was, in fact, the first general view of the timber question as affecting the colonies that was presented. At another time I shall be happy to state how that publication arose."

"Did you hear the evidence given before the Committee to-day in reference to the institution of a forest school?" "I did, some of it."—"Do you concur in that evidence?" "I concur entirely in the general advisability of instituting a forest school."—"And you have formed some opinions, I believe, as to the sources whence pupils would be drawn to such a school ; do you think it is likely there would be a considerable accession of pupils to such a school if opened on suitable terms, and in some central place in England?" "I think, perhaps, the best answer to that question is the number of land agency candidates whom we get in connection with our corporation examinations. Our examinations are held every year under three heads, chiefly land agency, chiefly valuation, and chiefly building ; the number of land agency candidates we get is on the average from fifteen to eighteen a year, and the number is growing considerably. Examinations have only been instituted under the charter during the last five years ; the number of candidates is increasing almost every year, and I apprehend that in time they will amount to a very considerable number. One of the subjects to which we attach great importance is the subject of forestry, upon which we have not only a written examination, but also a practical examination in the field ; it is a subject which we mark very high among our subjects of examination, and it is one to which we desire to attach more and more importance as our system develops. I think in all probability a very large accession of numbers might be calculated upon from the land agency class, who are, after all, the class in this country the most interested in the question of forestry."—"Could you give the Com-

mittee a rough idea of the number you would expect?" "It would depend very much upon the nature of the system of instruction. If it were such a system of instruction as would involve a prolonged residence, say, a year or two, it would have a tendency to seriously diminish the number of candidates; but if it were such a system as involved a residence of not more than two or three months, terminating with an examination, I think a large number of land agency candidates would avail themselves of it."

"You think much public advantage would be likely to accrue from the dissemination of a more accurate and trained knowledge of forestry amongst this class of persons you refer to, operating each in his own district of country?" "I think a large amount of good would result. I am not of the opinion that there is much ignorance amongst land agents with regard to forestry; but I am of opinion that what knowledge there is requires gathering up and systematising, and I think that would be done very well by a school of forestry."—"Is it consistent with your knowledge that the desire to see forestry more widely extended throughout the country is growing very considerably amongst this class of persons, and amongst proprietors and others interested?" "I think the proprietors are coming to see the very great importance of forestry, and I certainly think that land agents are turning their attention more and more to the acquiring of a scientific knowledge of the subject of forestry. We have the best possible test of the state of feeling upon the subject in our examinations, and in the papers which are read before the Institution upon subjects connected with forestry."

"I understand that the opinions you have expressed as to the desirability of instituting a school of forestry have reference to the requirements of this country as well as to the requirements of India?" "I am speaking mainly with regard to this country, but I believe it would be a very valuable source from which foresters might be drawn to fill appointments in the colonies; and what the state of things is in the colonies, from the want of scientific forestry, is revealed in the report which is before you."

This closed the evidence taken by the Committee during the only two days it was able to devote to the work of examination of witnesses.

VIII. *The Indian Forest School.* By Major F. Bailey, R.E., F.R.G.S., Director of the Forest School, Dehra Dún, N.W.P., India.*

It is only within the last twenty-five years or so that a special State Department has been in existence for the management of the Indian forests. Mr Brandis, who has lately retired from the office of Inspector-General of Forests, was mainly instrumental in organising the new institution, and he remained at the head of it until 1883. The superior staff was at first composed of selected civil or military officers who were thought to possess a natural aptitude for the work, but they had not received a professional education such as is given on the continent of Europe to officers charged with the management of State forests. At first, when the duties of the new department consisted mainly in acquiring control over the principal wooded areas in the country, and in preventing the unauthorised felling of trees upon them, a staff thus organised was all that was required, and Mr Brandis has repeatedly testified to the great value of the work accomplished by his subordinates in those early days. But the natural result of this work was, that the State became responsible for the efficient management of very extensive areas of forest land, which possessed great prospective value, and from which it was necessary to secure a permanent supply of timber and other produce to meet local demands both public and private. This could only be accomplished by introducing a regular system of management, which would prevent the removal from the forests of more timber than their growth could replace, and which would secure their regeneration either naturally or by artificial means, such as planting and sowing. It was further necessary that the forests should be made to yield the maximum amount of produce and the largest surplus revenue that they were capable of with due regard to their maintenance and improvement, and that all work in them should be done in the manner most likely to gain the desired ends, so that money should not be squandered on failures.

Questions of this kind had been studied for generations on the European continent, but very little was at that time known about them either in India or in England; and to enable him to make a beginning in the great work which lay before him, Mr Brandis obtained, in 1866, the services of two trained German

* Read at the British Association Meeting at Aberdeen, 1885.

forest officers, who had already gained practical experience by service in their own country. At the same time, acting under the orders of the Secretary of State for India, he made arrangements for the instruction, at the French and German forest schools, of a number of candidates for the Indian Forest Department. The first students were sent to these schools in 1867; but after 1871 no more of them were sent to Germany, as it was found more convenient to concentrate all the instruction in France, and although arrangements are now being made to carry on the theoretical instruction in England, the candidates continue to pass through the French school to the present day. Ninety-one officers trained in this manner have been sent out to India. The advantages which have accrued from the system adopted in 1866 have been incalculable, and the enormous strides that have been made in forest management in India are mainly due to the large number of professionally-trained men with whom the department has been recruited.

But up to 1869 nothing whatever had been done towards the professional education of the subordinate ranks. As the nature of the work in the forests gradually emerged from that of simple protection, and as operations requiring professional skill and experience began to be undertaken in localities at long distances from one another, it became impossible for the European officers to exercise the increased supervision over the large areas with the management of which they had hitherto been charged; neither could their number be largely increased, for this would have thrown too heavy a burden on the finances of the department; and thus it became necessary to subdivide the "divisions," as they are called, into a number of smaller charges under the executive control of natives of the country, and it was obviously necessary that these latter should receive a sufficient amount of professional education to enable them to carry out the orders they might receive from their immediate superior, the "divisional officer." No facilities, however, existed in India for the giving of this instruction, and Mr Brandis submitted to the Government proposals which embraced—

1. The organisation of the subordinate staff in the different provinces on a definite footing.
2. The selection of a certain number of apprentices, who, having received some practical training under selected

officers in their own provinces, should be sent to Roorkee or some other civil engineering college, in order to go through a course of mathematics, surveying and civil engineering.

The first of these proposals was declined by Government, but the second was accepted with some modifications, and twelve apprentices were ordered to be selected. The scheme, which was only intended as a temporary arrangement, did not, however, turn out a success; in some cases the men were not judiciously selected, in others want of organisation in the subordinate grades of the department led to a difficulty and delay in appointing them to suitable posts; while it became too much the custom to use the apprentices, during their period of practical training, before entrance to the college, in assisting current work rather than in learning their profession, and the system consequently fell into disuse. In the North-Western Provinces an attempt was then made to train candidates at the Civil Engineering College at Roorkee under a somewhat different arrangement, and in the Central Provinces a system of training apprentices was also commenced, while the Government suggested that the chief forest officers of the various provinces should seek for suitable men among the ordinary students at the Civil Engineering Colleges, and this was also tried. In 1876, Sir Richard Temple, then Lieutenant-Governor of the Province of Bengal, contemplated the establishment of a local school of forestry, but the project was not carried out, neither did any of the proposed arrangements give results that were considered completely satisfactory.

Things went on in this way until 1878, when Mr Brandis laid before the Government detailed proposals for the establishment of a Central Forest School, remarking that the necessary outlay would be covered within a few years by increased revenue produced under a stronger staff with more systematic management; and he added, that "a new era of forestry would commence, and a new impulse would be given to progress, by the professional education of Forest Rangers and Foresters." The Government, by a Resolution of the 1st July 1878, accepted these recommendations and ordered that a school should be established. It was said that the chief objects were to prepare natives of the different Provinces of India for the executive charge of forest ranges, and to enable forest rangers to qualify themselves for promotion to

the superior staff. It was pointed out that the existing system, under which the officers of the superior staff were trained abroad, presented great disadvantages; that India was dependent on Europe for the education of its officers, while it possessed ample means of teaching them in its own forests if a properly organised system were set on foot; that the natives of India, whom it was extremely desirable to employ in all grades of the Forest Department, could not, without a prolonged visit to Europe, obtain that systematic training which was necessary to render them competent to fill even the executive offices, and that on their account, as well as on that of others, the establishment of a school in India for the scientific teaching of the principles and practice of forestry had long been looked upon by the Government as an object to be effected. The Resolution of Government stated that the school would at first be utilised for the education of officers for the executive branch of the service, but that it was hoped ultimately to admit candidates for the controlling branch. The chief forest officers (conservators) of the various provinces were to select the candidates, who, after passing some time in learning practical work, were to be sent up to the school to follow the courses, returning after the completion of their studies for employment in their respective provinces. It was felt that this was the only way in which the selection of candidates could be effected; for if the men had been chosen by the Director of the school, they would probably, generally speaking, have been inhabitants of the North-Western Provinces, who would consequently have been unsuited for employment in many of the other provinces. The use of the school by Conservators of Forests, to train the men selected by them, was to be entirely permissive, and it was not at first made available for men from the Madras and Bombay Presidencies, while none but natives of India were to be admitted. At that time there were 15,000 square miles of demarcated forests in the Bengal Presidency, and it was said that if 25 square miles were taken as the average size of a range, 600 trained rangers would eventually be required. The then-existing staff of rangers and foresters consisted of 327 men, a portion of which number it was necessary to recruit from the lower ranks (forest guards), and hence it was thought that the number of trained rangers might be put at 200, and that 10 men sent out annually from the school would suffice to recruit a staff of that strength. It was determined to group together a number of

forests situated in one locality, so as to form a training ground for the students, and to place them under the charge of a separate Conservator of Forests, who should also be Director of the school. Several places suggested themselves as being suitable for this purpose: there were the Dehra Dún, Jaunsár, and Bhágiratti divisions of the North-Western Provinces, the Darjeeling and Jalpaigori divisions of Bengal, as well as certain forests in the Central Provinces and the Punjáb; but the choice fell, ultimately, on the North-Western Provinces divisions, which were considered specially suitable on the following grounds—

1. They comprised a sufficient area of demarcated forest presenting a great variety of vegetation; they had been protected for a long time, and in some portion of them the demand was equal to the supply.
2. The forests were of great financial importance, and in them were to be found instructive arrangements for the transport of timber.
3. Some of the forests contained conifers and oaks similar to the European species, and the experience gained in Europe could thus be directly utilised in their management.
4. A portion of the forests was free of rights, and where rights existed they were clearly defined; fire protection and plantation work were also in progress.
5. Hindustani is the language of the North-Western Provinces, and it is also spoken in the Punjáb, Ajmere, Oudh, and part of Bengal, as well as in the Central Provinces and in Berár. Further than this, the head-quarters of the Forest Survey Department were at Dehra Dún, and it was proposed to unite the two offices of Superintendent of Forest Surveys and Director of the Forest School.

The locality once fixed upon, it became necessary to provide an efficient staff of officers to work under the Director, in order both to bring the school forests as rapidly as possible into a condition in which they could advantageously be used as a training ground, and to impart theoretical instruction in the lecture room, as well as to give practical instruction in the forests. It was necessary to draw up working-plans or schemes of management, to establish experimental plots which could be systematically subjected to different kinds of treatment, to form a library, a chemical

laboratory, a meteorological observatory, a forest garden and other things. A Board of Inspection was appointed to examine the plans of operations and generally to advise the Director of the school. The age of admission was fixed, a medical examination was prescribed, and the minimum standard of educational acquirements on entrance was laid down, the programme of studies at the school being indicated. Fees for instruction at the school were not to be charged, but eight scholarships of fifteen rupees a month each were placed at the disposal of the Inspector-General of Forests. Passed students were to be entitled to receive an appointment, paid at the rate of twenty rupees a month, within three months of their leaving the school.

The Director was appointed and the school was officially constituted from the 1st September 1878; but the needful staff of officers could not be provided at once, and as they were by degrees made available, they were employed in organising the forests; so that, although a few men were received and given such practical instruction as was possible, it was not until the summer of 1881 that the first theoretical course was held in the school. This, as well as the subsequent courses, was attended by a small number of officers of the superior staff, who had not had the advantage of a professional training in Europe. It was not found possible at that time to impart instruction in the vernacular of the country, but care was taken that all the students were familiar with the English language.

The experience gained during the first year led to certain modifications being made in the system as originally proposed, and these were adopted in 1882. A course has been held every year since then, and the system has been gradually improved and developed, until it now stands as follows:—Candidates are selected either by the Director of the school or by the Conservators of Forests of the various provinces. They must on admission be between eighteen and twenty-five years of age and must furnish a certificate of sound health, including good vision and hearing. The officer who selects them must satisfy himself that they are of good moral character and have active habits, fair powers of observation and sense of locality. They must have proved their fitness for forest work by previous service in the subordinate staff of the department for not less than twelve months. There are two courses at the school; one in English for the Rangers' Certificate, and the other in Hindustani for the Foresters' Certificate. Candi-

dates for the former must have passed the entrance examination of an Indian university on the English side, while candidates for the latter must have passed a lower examination and have a competent knowledge of Urdu or Hindi. The students are required to assemble on the 25th June of each year. The course of training for the Rangers' Certificate extends over eighteen months and that for the Foresters' Certificate over twelve months. The Director has power to dismiss any student for misconduct and to remand any man who is not sufficiently promising. Successful students who have obtained the higher certificate may, on their return to their provinces, be appointed rangers; but those who have obtained the lower certificate only must serve satisfactorily as foresters for at least two years, after they return from the school, before they can be made rangers. No person who has not qualified as prescribed above can be appointed a ranger without the sanction of the Provincial Government. Candidates from Native States are dealt with as far as possible under the same conditions.

The course at the school for the Rangers' or English class is as follows—viz., for the first four months, from July to October, the students are taught vegetable morphology and physiology, the elements of physics and chemistry, mathematics, mapping, and the elements of road-making and building, the instruction being given in the classroom. During the months of November and December they learn practical surveying, including the use of the plane-table and spirit level, while during the remainder of the year they are taught sylviculture in all its branches, theoretical and practical, the instruction being given in the forest. The first four months of the second year are devoted to working-plans or schemes of management, forest utilisation, systematic forest botany, the elements of mineralogy and geology, the study of injuries to trees (by insects, by other plants, by wounds, bad soil or atmospheric influences), forest law, and mathematics. The last two months of their stay at the school are spent in the forest, and are devoted to practical exercises relating to the preparation of working-plans, including the following operations—viz., the division of a forest into blocks and compartments; the description of each compartment with reference to its situation and soil, the nature and condition of the crop, the lines of export and the cultural or other works required; the marking on the map of the distribution of certain

given types of forest growth; the enumeration of the crop; the collection of information relative to the previous history of the forest, the demand for produce and any special forest industries in the neighbourhood; lastly, the preparation of the working-plan based on the above. The total time occupied is eighteen months.

The course for Foresters in Hindustani is much simpler, and it extends over twelve months only. The first four months are devoted to the following subjects, which are taught in the class-room, viz. :—An elementary study of the growth and reproduction of plants, with the influences of soil and climate thereon, sowing and planting, mathematics, surveying and departmental procedure. During the next two months practical surveying is taught; and for the last six months of their course of instruction the students are taken into the forest and shown how to execute the most important of the works which they will be called upon to perform after leaving the school, such as felling, pruning, thinning, natural regeneration, protection against fire, and making lime and charcoal, as well as the measurement of timber and the construction of forest roads and simple buildings, and many other things.

While at the school the men are encouraged to play cricket and to engage in athletics, prizes being given for proficiency in such exercises as well as in professional subjects.

One of the great difficulties felt at the time the school was opened was the absence of suitable manuals of instruction, there being an almost entire absence of works on scientific forestry in the English language; books are, however, now being gradually prepared, and the needed works will doubtless be available shortly. Considerable progress has been made in forming a library; a museum, a small laboratory, and a meteorological observatory have been established; and a forest garden, in which various cultural operations are taught, is close to the school building.

A notable feature of the system of training adopted is that every student is required to go through a period of not less than twelve months probation in the forests before he enters the school. This rule has a twofold object. *Firstly*, it ensures that the students are all familiar with forests and with the nature of the work that is usually in progress in them, before they attend the classes in the lecture room, and they are thus in a position to understand what is there said to them. *Secondly*, it avoids

waste of time and money on the training of men who, from their tastes or otherwise, are unsuited for a forest life. As a rule, then, the students are already *employés* of the Forest Department, or are holding scholarships, at the time that they enter the school, and they continue to receive their allowances while they are under instruction; they are not charged school fees, but they maintain themselves while there. It would not be possible at present to obtain candidates whose maintenance and education are paid for by their relatives, but the existing arrangement will probably be modified as soon as the institution and the prospects of the men who pass through it become better understood. This will be the case when the subordinate grades of the department are more fully organised, and when the number of passed students of the school occupying good positions is increased. At the beginning of the present year nine men who have passed out since 1881 were holding appointments the salary attached to which varies from £125 to £200 a year, and this fact will no doubt have an influence in drawing eligible candidates to the school.

In his remarks regarding the last course of instruction, the officiating Inspector-General of Forests says that the present arrangement is thoroughly practical and works well, and that there can be no doubt that a very efficient professional education is secured to men who obtain the Rangers' Certificate. Those Conservators of Forests who have given an extensive trial to the education afforded at the school, have expressed their decided opinion that the passed students are markedly superior to their untrained comrades.

When making his proposals in 1878 for the establishment of the school, Mr Brandis stated that on 1st April 1876 the area of demarcated or reserved forests under the Government of India, *i.e.*, excluding those in Madras and Bombay, was about 15,000 square miles; but on the 1st April 1883, the date of the last available statement, the area in square miles of the forests of all classes in British India was as follows:

	Reserved Forests.	*Protected Forests.*	*Village Forests.*	*Total.*
Bengal, . .	35,667	3,397	18,428	57,492
Madras, . .	2,782	...	...	2,782
Bombay, . .	9,823	5,173	...	14,996
Total, .	48,272	8,570	18,428	75,270

The area of reserved forests has therefore enormously increased during the last few years; and as it will continue to do so for some time to come, it seems likely that the number of appointments which will ultimately become available for passed students of the school will be much in excess of that mentioned in the original proposals. During 1884 there were forty-six students of all classes at the school, of whom eight were from the Madras Presidency and seven were sent by the native chiefs of the States of Baroda in Bombay, Jaipur in Rájputána, and Patiála in the Punjáb. One highly satisfactory result of the establishment of the school is that it has been the means of inducing the chiefs of several of the most important native States to undertake measures for the protection of their forests. A few of those junior officers of the superior staff who have not been trained in Europe are sent up each year to attend the theoretical course, and it is hoped that the whole of them will ultimately be passed through the school in this manner.

At first the school at Dehra Dún was a provincial institution, under the Government of the North-Western Provinces and Oudh; but this was found inconvenient, and it has now been placed directly under the Government of India. This is a very great improvement on the previous arrangement. The expenses of the school during 1884 are said to have been 22,934 rupees, or about £1720.

IX. *The Douglas Fir* (Abies Douglasii, *Lindley*). By Angus D. Webster, Forester, Penrhyn Castle, Bangor, Wales.

There can be no doubt that in the Douglas fir we have one of the most valuable additions to our forest trees, whether in an ornamental or a commercial sense, that has ever been made. The rapidity of growth, and early age at which this tree forms a considerable bulk of valuable timber, renders all information bearing on its extended cultivation as a forest tree of much importance to the Arboriculturist.

Although named in honour of David Douglas, the celebrated Plant Collector, this tree was first discovered by Archibald Menzies, who accompanied Vancouver, as naturalist and surgeon, in his celebrated voyage round the world (1790-1795). It was rediscovered, and seeds sent home in 1827 by Douglas, while collecting for the Royal Horticultural Society of London, and who introduced such numbers of valuable trees and shrubs from North America. It is a native of the North-Western coast of America, extending from Mexico to Vancouver's Island, and from the Pacific to the Rocky Mountains. In Oregon and Washington Territory it is found in dense forests, growing to the height, it is said, of nearly 300 feet, and with stems of from 7 to 10 feet in diameter.

The habit of the tree and the quality of its timber, however, vary considerably according to locality; thus, in British Columbia where it attains an average height of about three times what it does in the Rocky Mountains, the timber is highly esteemed, being clean and elastic; while in the mountain districts where it seldom exceeds 100 feet in height, the wood has the reputation of being hard, resinous, and very liable to warp.

In Britain the Douglas fir has proved perfectly hardy, of very rapid growth, a most graceful tree for ornamental purposes, and a valuable timber producer. I am, however, rather dubious as to its value for planting in exposed situations, for several experiments in this way have proved anything but satisfactory. Here, where the tree has been planted pretty extensively, a prevailing evil is the repeated loss of leaders, which, on over-topping the surrounding trees, are liable to be broken over, thereby giving to many of our finest specimens a flat or table-headed appearance.

Along the outskirts of several mixed plantations, wherever in the least exposed to either the southern or south-western blast, this

tree cannot be considered as at home, for the twisted, weather-beaten appearance of the foliage in such positions betokens anything but that the tree is properly situated. Even when planted along the outskirts of the woods surrounding the park, where the elevation hardly exceeds 100 feet above sea-level, the results obtained from this tree are by no means encouraging, certainly not sufficiently so to warrant its being extensively used in such situations. In passing, it should, however, be noted that, owing to the peculiar situation of this estate, and being both mountainous and maritime, the storms are at times particularly severe, more especially when the wind is blowing from the south or south-west. Where planted as a general forest tree, the Douglas fir does exceedingly well for the first twenty or thirty years, but, on out-growing its neighbours, the leader and upper branches being, from their rapid growth, somewhat fragile, generally get destroyed, and present from their naked, leafless appearance, anything but a desirable feature in well-managed woodlands. Still, this might, to a great extent be averted, and should certainly not be a deterrent to the extensive planting of the tree in suitable situations, as I believe that a plantation formed of this tree alone, or along with the silver fir—whose rate of growth most nearly approaches that of the Douglas fir—would succeed better, and be less liable to injury during a storm, than when mixed up with the general run of forest trees. This has indeed, to some extent, been already proved here, as in a few of our woods where belts of this fir alone were planted, they have succeeded better, and are not nearly so liable to injury during stormy weather as those placed singly throughout the same plantations. With this end in view, we, some time ago, formed a small plantation of the Douglas fir in a low-lying, well-sheltered piece of ground within a short distance of the sea. The plants used were strong, bushy, well-rooted specimens from 3 to 4 feet in height, and planted at 8 ft. apart, the intervening spaces being filled up with larch for removal at an early date. The Douglas fir as standards can thus be left at 16 or 24 feet apart, as afterwards found practicable. The soil is good strong loam, from which, as well as the sheltered position, I have every reason to expect more satisfactory results than have hitherto been obtained here from this fir.

The timber of this tree is clean-grained, elastic, and durable, of a colour almost as deep as yew, and susceptible of a fine polish. Several spars grown here have been used by boat-builders on the Menai Straits, and which, from information elicited a few days

ago, have stood the test well, and given, so far, the utmost satisfaction. We have also sawn up several large trees for boarding, etc., the wood of which appears strong, firm, and beautifully grained, and has been applied experimentally to various purposes on the estate. It would, however, as yet be premature to speak with any amount of assurance regarding the value of the wood as grown in Britain, no trees having attained an age at which the timber could be considered mature.

The following interesting experiments, conducted by Mr Wilson Saunders of "Lloyd's," show the great superiority of the wood of the Douglas fir over the others experimented upon. Lengths of each of the woods enumerated in the following table, carefully squared to $1\frac{1}{4}$ in., were submitted to pressure of weights pendent from the centre, the lengths being supported between standards exactly 6 ft. apart.

The weight at which each broke, and the amount of deflection from the horizontal line at the time of breaking, are given :—

	Lbs.	Inches.	
Douglas Fir, . .	280	4	Fracture rough and long.
Pitch Pine, . .	280	4	Fracture short and even.
Canadian Spruce, .	196	4·7	Fracture short and rough.
Red Pine, . . .	168	6	Fracture rough.
British Larch, . .	168	5·2	Fracture short and even.
Deodar from the Himalaya, . . .	154	3·8	Fracture short.

The specimens experimented on were carefully selected from the best description of woods and free from all defects. Each variety of wood had two trials, and the figures give a mean result.

It will be seen from the above figures that none of the firs approached in strength either the Douglas fir or the pitch pine, and while these two were equal in strength there was this difference, that while the latter snapped short under a strain of 280 lbs., the Douglas broke slowly and toughly with a rough and long fracture.

As an ornamental tree the Douglas fir can hardly be surpassed. The dark evergreen, yew-like appearance of this tree, combined with its rapid rate of growth and massive proportions, renders it admirably adapted for planting along the outskirts of plantations that can be seen from drives or walks, where it forms a striking contrast to other trees of a more light and airy appearance.

Perhaps at no season of the year has the Douglas fir finer or more ornamental appearance than during the months of June and

July, when the rich brown buds, with which all the branchlets are tipped, burst and reveal the young leaves. At first these are of a bright pale colour, and at a distance make the tree appear as if studded over with countless yellow blossoms, the contrast between this and the older foliage being strikingly beautiful.

The appearance of the tree is usually very symmetrical, with an erect, taper trunk, smooth when young, but when old, covered with rough, rugged bark, thickly studded with receptacles full of clear yellow resin, as in the Balm of Gilead fir. The branches are long, horizontal or slightly pendulous, and clothed with innumerable slender, drooping sprays, handsomely feathered with an abundance of short, dark vivid green leaves. The cones, which vary from 2 to 3 ins. in length, are, when fully matured, of a bright brown, at first nearly erect, but afterwards pendent.

Scales of the cones are concave and persistent. The leaves are about 1 inch in length, flat, obtuse at the point, furrowed on upper side, and slightly twisted at base. The male catkins are usually numerous, of a reddish-fawn colour, and produced from the lateral and under sides of the branchlets. The cones should be collected, according to the season, in September or October, as, if left after that time, the seeds fall out and are lost.

As regards the quality of soil, the Douglas fir seems to adapt itself to almost any kind—wet or dry, smooth or rocky—provided that the subsoil is of an open, porous nature. In dry, sandy soils, where the larch and spruce are affected with dry rot, the Douglas fir is quite at home, and luxuriates admirably.

On this estate the largest and finest specimens are growing on sandy loam, in a somewhat sheltered position along the banks of the Ogwen river, although many of almost equal dimensions may be found growing on soils of a more retentive nature. Even in well-drained clay and peaty soils this tree luxuriates and grows at a rapid rate, as many notable instances throughout the country amply testify.

Excepting *Pinus laricio*, the Douglas fir has perhaps been more extensively planted on this estate than any other tree of recent introduction, but at an early date more as an ornamental tree than for ordinary plantation purposes.

Within the park are some very fine specimens, which, judging from their large size, must have been planted within a few years after the introduction of the tree in 1827.

Close to the carriage-drive leading from the Castle to the village of Llandegai are three of unusual dimensions, as shown by the following figures :—

	Feet.	Inches.
No. 1.—Height,	81½	6
Girth of stem at 1 foot up,	13	6
Girth of stem at 5 feet up,	11	2
Diameter of spread of branches,	61	0
No. 2.—Height,	76	0
Girth of stem at 1 foot up,	13	7
Girth of stem at 5 feet up,	12	2
Diameter of spread of branches,	69	0
No. 3.—Height,	74	0
Girth of stem at 1 foot up,	10	2
Girth of stem at 5 feet up,	10	0
Diameter of spread of branches,	57	0

These trees are well clothed to the ground with bright, glossy foliage, seem in perfect health, and would have been, perhaps, the finest specimens of their kind in Britain had their leaders not been broken over. As it is, the stem girth of these trees is not exceeded by any others of the same kind in this country.

That the stems of these specimens are not what is called "carrot-shaped" will readily be seen when I state that the girth of each respectively, at 17 feet from the ground level, is: No. 1, 9 feet; No. 2, 9 feet; No. 3, 6 feet 6 inches. The contents of the largest tree, irrespective of branches, is 192 cubic feet.

On the sloping and somewhat sheltered ground near the mouth of the river Ogwen, many trees of greater height are to be seen, but none approach the three whose dimensions are given above in size of stem. Many solitary specimens of the Douglas fir, planted for lawn embellishment, have attained large dimensions in various parts of the kingdom. At North Stoneham Park, Southampton, there is a fine tree, probably one of the first introduced, which has attained a height of about 80 feet. The soil is "bog mould," on a gravelly subsoil of the Bracklesham beds. In an arboretum formed by the late Mr Taunton of Ashley-in-Combebottom, Hampshire, the largest specimen in 1881 was over 90 feet in height, and contained 60 feet of timber, the result of forty-one years' growth. The soil is clay mixed with the *débris* of the chalk formation. At Blackmoore, Selborne, the seat of the Earl of Selborne, there are some magnificent specimens growing on peaty sand on the Folkestone beds.

In Scotland, on various classes of soils and exposed situations, the Douglas fir does well, and forms a considerable quantity of timber in a short space of time. On the Pentlands, at Belstane, this tree is doing remarkably well, many having now attained a height of fully 50 feet, although the soil is poor and cold, and the situation very exposed.

At Churchhill, Co. Armagh, Ireland, this tree also does remarkably well on deep peat-bog, mixed with a little clay at time of planting. The largest specimen, planted in 1862, is now about 80 feet in height, with a stem of 5½ feet girth at 3 feet up. Other specimens, planted at the same time on prepared bog, are all doing well, several being models of beauty.

The Manager of Woodlands in the Isle of Man writes as follows regarding the Douglas fir: "This is indeed a splendid fir, and in sheltered positions will probably surpass every other conifer, native or foreign, as it not only quickly attains a large size, but its timber is of admirable quality. When exposed, however, to the sea breeze, its leading shoot is almost invariably destroyed; and, although the tree quickly replaces it, the process of destruction is fatal to the production of long, straight timber. For this reason my trees have not attained a greater height than 40 feet, but they spread laterally, and increase quickly in girth."

From the above records it will be readily seen that the Douglas fir thrives on a great variety of soils; but to produce the largest and finest specimens, a partially-sheltered situation—sheltered, at least from the prevailing winds of the district—is necessary.

This tree is readily propagated from seed, which is borne in great quantity even by young trees; but it is well to remember that cones collected from medium-sized, healthy trees growing in a somewhat exposed situation are always preferable. It has, however, been said that plants raised from British seed are inferior to those grown from seed produced in its native country. This is not at all in accordance with my experience of the tree, as the following facts will show: Here, where the tree has been planted by the thousand, all the stock has been raised in our own nursery, from the same parent trees—those whose dimensions are recorded above. The plants, instead of degenerating, have turned out most satisfactory, which the dark, glossy green foliage and rapidity of growth clearly testify. Many of these have already attained a greater height than the parent trees, more especially such as were planted in low-lying, sheltered situations; indeed, I find it impossible to detect the least

difference between these and such as have been raised from seeds sent from their native country. I have not the least doubt, however—in fact, it has been proved beyond dispute—that seeds collected from immature trees, or such as are grown in a situation unfavourable to their healthy development, produce a sickly and degenerate offspring; but this is hardly to be wondered at when the laws of nature are carefully studied.

The nursery management of the Douglas fir is by no means difficult, for with but a small amount of trouble or attention, strong, well-rooted plants may be produced. When the seeds are collected in autumn, they should be thoroughly dried in a sunny and airy situation, after which they may be stored away in a cool, airy loft until wanted for sowing in spring. The system usually adopted of storing seeds in bags or close boxes is, in most cases at least, not to be commended.

The best way is to spread the seeds out evenly, and rather thinly, in shallow, open boxes, when, unless the room in which they are stored is damp, the germinative properties are retained uninjured. Early in March, according to the season and district, the seeds should be sown on well pulverised soil, of a light open texture, previously well dug and broken up, and all the better if the soil has been fully exposed to the ameliorating influence of a winter's frosts. The beds should be formed about 4 feet in width, leaving an alley between each about 15 inches wide for weeding and keeping them in proper order. The seeds should be sown thinly, but evenly over the surface; and after receiving a slight rolling or beat with the back of a spade, are covered to the depth of about half-an-inch with finely riddled leaf mould and sand. One pound weight of sound Douglas fir seed will produce from 7000 to 10,000 plants. The seed-beds require to be protected from birds and vermin, as the former often eat the seed, and the latter destroy the young plants. The injury to seed-beds by rats, mice, and birds, is often very considerable, and has led us to adopt the following simple method of protection, which we have found of great benefit, and which we can with every confidence recommend to others troubled with these nursery pests:—The ground intended for seed-beds is surrounded with a close slate fence (wood will answer the same purpose) 3 feet in height. Upright stakes are also driven in 8 or 10 feet apart, and projecting 3 feet above the slate fence, and the whole covered over with fine wire netting. Slate has the advantage over wood for this purpose, as neither rats nor mice can climb up their smooth sur-

face. Where a wooden fence is made, it will be found necessary to run a piece of zinc or tin along the top of the fence, and at right angles to it, which will prevent the inroads of all such climbing vermin.

After remaining for two seasons in the seed-bed, the young plants should be carefully raised and replanted in lines in another part of the nursery. The lines may be 12 inches apart, and the seedlings planted at a distance of 3 inches from each other in the rows. Here they may remain until they begin to crowd upon each other, when they should be lifted and replanted, the size and growth being a good guide as to their distance apart in the nursery lines. As the Douglas fir can be removed with the greatest safety when of a large size, we have found it better to allow the plants to remain in the nursery borders until they have attained a height of from 2 to 3 feet, when, if the above instructions are carefully carried out, strong, bushy, well-rooted specimens will be the result.

X. *The Formation of Plantations, and their Management for the First Twelve Years.* By DAVID A. GLEN, Assistant Forester, Gartshore, Kirkintilloch.

In forming a plantation, the greater the amount of area enclosed the better for the future welfare of the crop, as it is an unquestionable fact that trees as a rule thrive better and attain greater dimensions when grown in an extensive plantation than when grown in isolated clumps. The reason of this is obvious. In the former case each tree is sheltered by and affords shelter to its neighbours, while in the latter they are exposed on all sides to every variation of temperature, and, as a result, they generally assume a stunted, weather-beaten appearance. On elevated lands such results are more noticeable than on low-lying situations, as the more elevated they are the exposure to the blast is generally greater. This, then, should be the first rule to be observed in forming a plantation on a situation not naturally sheltered, to plant as much and as compactly as possible. Land that has been newly cleared of a timber crop should not be planted for several years, as the supply of nutriment in the soil is much exhausted. By allowing it to remain for a few years it stores up a fresh supply of nutriment for the maintenance of the next crop. Another reason why such lands should not be planted immediately after clearing off the old crop is, that the old roots, stumps, and refuse are allowed to decompose, and the insects with which they are infested gradually disappear. In the meantime the land may be profitably and advantageously utilised for grazing purposes, as the cattle, besides keeping down rank vegetation, contribute to the firming of the soil. Before planting operations commence, it is necessary to ascertain such information as the following: 1st, The extent of proposed plantation; 2d, a knowledge of the nature of the soil and situation; 3d, what particular kinds of plants are most likely to succeed on such soil and in such a situation; 4th, what particular kinds of timber are principally in demand in the immediate neighbourhood, and to what extent it will be advisable to plant such trees in the proposed plantation. Such information will enable the proprietor to select his plants with discrimination, and submit them to proper treatment.

Selection of Plants.—As in animal life the continuation of species is accompanied by a transmission of the good or bad qualities possessed by the parent stock, so in the vegetable kingdom we find the same law in operation. Consequently, if we gather seeds from

immature or unhealthy trees, we cannot expect from them to gain a healthy and unaffected progeny. The reasoning on the question amounts to this: If we sow seeds obtained from a healthy tree of proper age and condition for giving off a good offspring, we procure good healthy plants; while, on the other hand, if we sow seeds collected from trees of opposite conditions, we are rewarded with a progeny of vastly inferior quality; hence arises the question, Which of these two classes of plants will we select for the formation of a plantation? Reason and common sense teach us that if we wish to raise a healthy and profitable crop we must, in the first place, select plants that are well-rooted, healthy, and free from hereditary blemish. It undoubtedly affords the proprietor, and also his forester, a great amount of satisfaction, when he is able to collect, on his own estate, all the seeds he requires from trees in such a condition as he considers best for giving off a good and healthy reproduction. Such cases, however, are the exception, not the rule. From various causes it is not easy, within the compass of one estate, to find all our common forest trees in such condition as to make it desirable to reproduce them. With nurserymen, however, the case is different. Their operations being extensive, they do not confine themselves to one estate or locality; hence they are able to procure the various seeds from trees growing under the most advantageous conditions. As a consequence, good plants can be obtained at the public nurseries at such reasonable prices that it would be questionable economy to expend time and money in the collection, preparation, and sowing of home-grown seeds from which to raise the future plantations on the estate. The system of raising plants from home-grown seeds is, when judiciously practised, very commendable; and, experimentally, it is practised on the majority of estates throughout the country; but, except in the case where the estates are very large and the operations extensive, it is not advisable to practise the system beyond the limited bounds of experiment. The system now most generally practised is to procure one-year or two-year seedling plants from the public nurseries, and to have them conveyed to a home nursery on the estate on which they are intended to be grown. By remaining there one, two, or three years, as may be considered necessary, they become acclimatised to the neighbourhood, and are rendered less liable to receive injury from climatic influences when placed out in the plantation than plants that have been reared at a distance. The home nursery should be dry and airy, sheltered but not confined, and consisting

of a free, light soil. Possessed of a home nursery well stocked with the necessary plants in their various stages of development, the forester has an opportunity of subjecting them to such a course of treatment as he considers essential to secure their success when planted out. Towards this end it will be found to be greatly to the advantage of hardwoods to have them transplanted and carefully root-pruned about eighteen months previous to planting out. To secure good, healthy, well-rooted plants, specially adapted to the various situations they are designed to occupy, is one of the most important conditions for the successful formation of a young plantation. In selecting, soil, elevation, exposure, and local demand must be the main considerations. Some plants thrive in situations that would prove certain death to others; hence the necessity for careful discrimination as to the nature of the various plants, and their adaptation to given situations and conditions. If we put very small plants on low-lying situations where vegetation is rank and strong, the herbage soon gains the mastery, overgrowing them, and cutting off their essential supply of air and light, thus preventing them from discharging their proper functions. Again, if we place plants of a large size on a situation that is elevated and exposed, the transition to such a situation from one of more temperate and genial conditions, if it does not kill them outright, at least gives them a very severe check. Further, when we come to consider the matter of suitability of soil in making a selection, we find that some plants luxuriate in places where others would either not grow at all or thrive but indifferently. Many of our forest trees are very accommodating as to soil, though, as a rule, they each require a particular soil and conditions to attain to their most perfect development. On a low-lying situation, sheltered, and soil consisting of a rich dry loam, most hardwoods will succeed. Oak, however, is partial to a heavy soil; so also is ash, if the soil is of a moist nature. On the other hand larch, beech, Scots fir, and birch are more partial to soils of a light nature. For deep mossy ground Scots fir and birch are best adapted; and for moist or wet soils, spruce, poplar, lime-tree, alder, and birch are the most suitable.

Draining.—The thorough drainage of a young plantation is an indispensable condition for the successful raising of a timber crop. On the question of the depth to which woodland drains should be cut, different opinions are held. Some maintain that from 3 feet to 4 feet, according to the nature of the soil, is the proper depth, while others hold that drains cut to the depth of 18 to 24

inches to carry the water off the subsoil, are quite sufficient. So far as my brief experience enables me to judge, I am inclined to think that the drains ought always to be cut to a greater depth than the principal roots of the trees are likely to attain, in order to prevent the lodgment of stagnant water about these. On wet marshy lands, where water lies sour and fetid, the drains should be made about two years before planting, in order to allow them time to carry off the deleterious effects of long stagnation. On stiff clay lands, which are of a retentive nature, the drains should be cut at 10 yards apart. Woodland drains being permanently open, they must necessarily be cut to a much greater width at the top than at the bottom, otherwise by the action of the weather on them the sides would crumble in and the drain be rendered useless. The width at the top, therefore, must vary according to the depth of the drain, and the width at the bottom to allow the sides to be well sloped. On open gravelly lands drains may be cut at 20 yards apart; such land being unretentive, it is undesirable to put the drains too close. All woodland drains should be not less than 8 inches wide at the bottom, to allow of their being easily cleaned with an ordinary spade. On moss the drains must be deeper and wider than on other lands, to make allowance for the subsidence of the soil. All drains should be made not less than six months previous to planting, as this gives them some time to act upon the soil, and to dispel sourness. The soil cast out of the drains should be well broken and scattered lightly over the ground.

Road-making.—For the planning and formation of roads the best time is previous to the commencement of planting operations. At that time the inequalities of the ground are seen to better advantage, and are more easily avoided or contended with as may be deemed necessary. Further, it will often be found much more convenient to convey material for the bottoming of such roads when the ground is bare than it would be if it were under crop. Main roads should always be planned to take such a course as is best adapted to future convenience. When it is remembered that the removal of the crop is the object of their construction, the necessity for convenience and efficiency at once suggests itself. From 15 to 18 feet is the width that such roads are generally made, and they should have a bottoming of not less than 10 feet in width. To secure and to maintain efficiency these roads must be kept dry, and for this purpose a drain must be cut on either side of the road from 18 to 24 inches in depth. For the reception of the bottoming

a track should be cut to the depth of a good spading, though it will sometimes be found necessary to make up deficiencies of the ground instead of taking anything off. Land stones carefully laid to the depth of 10 inches, and covered with rough gravel, make a very effective road if it is kept dry and free of ruts. When forming a road through moss the most effectual plan to keep the bottoming from sinking is to put a good heavy coating of spruce branches beneath it, keeping them 2 or 3 feet extended beyond the edge of the bottoming at each side. Old stone dykes forming fences within the enclosure should be taken down, and if not used for the building of new fences, should be utilised for the purposes of road-making. Besides main roads in a plantation of any extent, bye-roads are also necessary for the removal of thinnings and for easy access through the plantation. They are likewise generally adapted for the convenience of sportsmen. The breadth of such bye-ways is commonly about 9 feet, and as they are not designed for the removal of timber by cartage, they need not necessarily be laid with bottoming.

Fencing.—In order to protect the young plantation from the ravages of live stock, it is absolutely necessary, before commencing planting operations, to have it properly fenced. The modes of fencing such enclosures are various, and in a great measure depend on local facilities, the nature of the surroundings, the class of animals to be kept out, and other considerations. Live fences, such as thorn, hornbeam, and beech, when sufficiently strong and close-growing, are very effectual; but these, in order to be raised, must be themselves protected by a temporary wire or wooden fence until they attain sufficient strength to enable them to resist attack. For this reason it is undesirable in forming a plantation to enclose it with young live fences, though existing fences of this class, if healthy, close-growing, and strong enough to resist attack, and forming the boundary line, should be carefully gone over and made as perfect as possible. Where gaps occur they should be filled up with strong, vigorous plants, similar to those of which the fence is composed; and dead plants should be removed and others substituted. Wire fencing has the recommendation of being comparatively cheap, and it is, when properly erected, thoroughly effectual for years. Where heavy cattle are to be kept out a stronger fence is necessary than would be required for sheep, while to keep out the latter, the fence must be a great deal closer in order to prevent them from going through. In wire fences erected for the

purpose of keeping out heavy stock, the posts should be all of larch, not less than 4 inches in diameter. They should be pitted and made firm in the ground with a beater, and they should have not less than five wires; the top and the third or fourth wires being heavier than the others, as persons in crossing a wire fence generally put their weight on these, besides, the top wire is the most open to the attacks of cattle. Fences of a light description are protected by having a barbed wire on the top, which proves a very effective means of saving them. In wire fencing for sheep, the posts should likewise be of larch, but need not be so strong as those used in fencing against heavier stock. In this fence the posts may all be driven into the ground, with the exception of the straining posts which require pitting. It will be necessary to put wires closer on this fence to prevent the possibility of sheep or lambs getting through it. The most effectual permanent fence for such enclosures, however, is a well-built dry-stone dyke, which is rendered even more so if the cope be built on with lime. Where material is convenient, this will be found in the long run to be the most economical method of enclosing plantations.

Ground Game.—Ground game is undoubtedly one of the greatest enemies that has to be contended with in forming a young plantation, and the only effectual antidote against their ravages is wire-netting. To be effectual, wire-netting should be of 1½-inch mesh, and not less than 36 inches across the web. It should be erected 4 feet within the boundary fence of the enclosure, to be out of reach of the cattle from the outside. The netting should be sunk 3 or 4 inches in the ground, attached to posts about 5 feet apart, and attached at the top to a wire, or wooden rail, stretched along the posts about 32 or 33 inches from the ground. After the ground has been enclosed with this netting, all the game within the enclosure should be shot, trapped, or destroyed by any other means that can be devised.

Clearing.—Previous to planting, the ground should be cleared of all refuse. Solitary trees should not be allowed to remain, and all manner of scrub rooted out and removed or burned. If the ground has formerly borne a timber crop, it should be carefully raked, and every chip and twig that remains of the previous crop collected and burned, as they afford harbourage to destructive insects.

Planting.—In conveying plants from the nursery to the ground enclosed for the future plantation, great care should be taken to prevent the roots from being exposed to the air; and as soon as

they reach the ground they should be laid in rows in a shallow trench, and the roots well covered with earth or turf. The planting of hardwoods should begin about the end of October or the beginning of November. They should be planted in pits about 15 inches square, or even larger, if a pit of that dimension does not allow the roots to be spread properly. These pits should be dug about two or three months previous to planting, as the action of the air improves the soil, and renders it better adapted for the formation and maintenance of rootlets. In planting, care should be taken to spread the roots well out, to put the finest soil next them, and not to bury the plants too deep. When planted, the pruning-knife should be judiciously applied to contending leaders and disproportionate branches. Conifers of a large size should be pitted in the same way, and the smaller ones planted by the system of notching. Notching is accomplished by making two cuts with the spade in the form of the letter T. By retaining the spade in the last cut (which runs at right angles from the operator), and pressing the handle downwards, the notch is opened. When the plant is inserted, the notch is closed, and the plant firmed with the foot. When carefully done this proves a very successful mode of planting; while, on the other hand, many failures often can be attributed to no other cause than the careless execution of this simple operation. Some planters, by holding their spades in such a manner that the blade is not perpendicular when making the first cut (*i.e.*, the one running in a direct line with themselves), make it in a slanting fashion, so that, when the plant is inserted, it hangs to the one side. In kicking the turf to set the plant back to the perpendicular, the heel of the boot sometimes comes in contact with the stem, causing an ugly wound. Others, again, close the notch without properly inserting all the roots, or close it in such an imperfect manner that drying winds find easy access. These are points that should be well attended to, as much of the success of the future plantation depends on whether it has been well or indifferently planted. Observing the rules laid down for our guidance as to the adaptation of plants to soil and situation, we may, on low-lying, stiff clay lands sufficiently drained, plant oak, Scots (or Wych) elm, plane-tree, Scots fir, and *Pinus laricio*. A similar soil, moderately moist, will grow ash, poplar, spruce, alder, and birch. In such a situation the vegetation is apt to be rank and strong; therefore, the plants used should be, if moderately sheltered, of a large size, and may be planted at 5 feet apart; hardwoods from 4 feet upwards, and conifers from 14 to 18

inches high, would be a suitable size. In a sheltered situation, and soil consisting of a sandy loam, most of our forest trees would succeed; and as, under such conditions, many of the hardwoods would be in their element, it would not be advisable to plant them nearer than 12 or 15 feet, mixing them with larch, Scots fir, spruce, laricio, and silver fir. On moderate elevations, if the soil is light, open, and porous, larch may be very freely planted, mixing with Scots fir and hardwoods—birch, plane-tree, and even oak. Here the hardwoods may be 2 feet and upwards in height, and planted at 10 feet apart. Scots fir two-year seedlings, two-year transplants, and larch two-year seedlings and one-year transplants, may be planted at 4 feet apart. On high elevations, which are consequently much exposed, very small plants should be used. The hardwoods should not exceed a foot in height, and may be planted at 9 feet apart. Here, as shelter is the first object to be gained, the conifers may be planted 3 feet apart—using one-year seedlings and one-year transplants of larch, and two-year seedlings and one-year transplants of Scots fir. To ensure success, all the plants used should be well-rooted, free from aphis and other insects, and disease of every kind. They should have one distinct leader, proportionate branches, and (in season) a fair amount of foliage. Plants that are long and slender, of a yellowish green colour, and having a sickly, forced-like appearance, should be rejected.

Management of a young Plantation for the first twelve years.—The management of a young plantation for the first twelve years is a duty requiring considerable care and watchfulness. The fences, and especially the wire-netting, must be regularly and carefully examined, weak parts and breaches repaired. During each planting season, for the first few years, the plantation must be gone over and blanks filled up; while each summer it must also be visited, and rank grass, that has a tendency to overgrow and choke the plants, cut to allow the free admission of air and light. The hardwoods must be well looked after, contending leaders and disproportionate branches unsparingly kept under by the pruning-knife. Where contending leaders occur in conifers, they should be checked by nipping off one of the rival buds. Thinning should be commenced as soon as the trees show signs of being hampered. The first thinnings being generally too small to be of any account, they should be carried to an open space and burned; for, if allowed to lie on the ground, they harbour insects. Young plantations should be thinned frequently, but never severely. Drains should always be kept in working order.

XI. *The Corsican Pine* (Pinus laricio). By Angus D. Webster, Forester, Penrhyn Castle, Bangor, Wales.

This noble tree was first discovered in dense masses in Corsica, whence it was introduced into this country in 1759 under the name of *Pinus sylvestris maritima*. Since that time, however, it has been found somewhat plentiful in Calabria on the Apennines in Italy, and on Mount Etna in Sicily, at elevations ranging from 4000 to 6000 feet. In these, its native habitats, it attains an average height of fully 100 feet, although from a trustworthy source we have learnt that in Corsica specimens 180 feet in height have been found; but these are certainly few in number, and may be considered as the giants of their tribe.

The Corsican pine is a tree of bold, erect habit, and more inclined to throw the vigour of its growth into the stem than in the formation of many or weighty side branches. The branches are rather short in proportion to the height of the tree, and grow almost horizontal, or are, more correctly speaking, slightly drooping, with up-turned points; but this is most noticeable in old specimens of the true type, and less so in those of younger growth. The Calabrian form is far more pyramidal in contour than the Corsican variety. The leaves are in pairs, slightly twisted or undulate, and from 4 to 6 inches in length; cones usually solitary, but sometimes in twos and threes, sessile, and varying in size from 2 to 3 inches in length, and a little more than an inch in diameter. This tree is not unfrequently confounded with the Austrian pine, but this is not to be wondered at, when we consider how nearly, in some cases, these trees approach each other; indeed, on this estate, intermediate forms linking the two trees together are by no means uncommon.

The typical forms of each are, however, perfectly distinct, being quite dissimilar in habit, foliage, rate of growth, quality of timber, and general appearance.

The following differences taken from genuine specimens of these two trees, standing side by side, and nearly 60 feet in height, are always observable, and may be relied upon as correct:—The Corsican pine presents a far more light and airy appearance than the Austrian, which is due in a great measure to the foliage being of a much lighter green, and the branches fewer and less thickly covered with leaves. The leaves are shorter and less stiff than those of *Austriaca*, and usually, though not always, undulate or twisted—this latter being an unerring point of difference between the two trees.

The foliage is also of a more silvery hue, with less inclination to be tufty or massed, and the tiers of branches much further apart, this being due to the quicker rate of growth. The cones of *Laricio* are much smaller, less spiny, and also less persistent than those of the *Austriaca*, and seldom stand so erect.

To the French great credit is due for having first drawn attention to the value of *Pinus laricio* as a timber tree, for as early as the time of Louis XVI. it was used for various purposes in ship-building, such as for beams, flooring, and planking. In 1788 an investigation into the tree and the quality of its timber was set on foot, and two engineers were sent out by the Administration of the Marines to examine the principal forests in Corsica. Later on, in 1814, the French Government, who appear to have always highly appreciated the pine, appointed M. Thouin to draw up a report on the cultivation and general management as well as value of the tree for economic purposes.

Although introduced to this country as early as 1759, few trees of the *Laricio* have attained a greater age than sixty years. This is attributable to the great scarcity of seeds, which, even so late as 1822, could not be procured in sufficient quantity for planting the royal forests of France, and which at that time led to many thousands of the *Laricio* being grafted on the Scots fir. The largest specimen of the *Laricio* in this country is believed to be one at Kew, which probably is one of those introduced in 1759, and would therefore be about 125 years old. In 1838 Loudon figured this tree, it being at that time well branched to the ground, and about 85 feet high. Selby, in his "Forest Trees," published in 1842, mentions the same tree as being then 90 feet in height. It is now 88 feet in height, with a girth of stem at 3 and 5 feet, of 8 feet 11 inches and 8 feet 9 inches, respectively. At widest part the spread of branches is from 55 to 60 feet. The above measurements, taken October 29, 1884, were kindly furnished me by Mr Nicholson, of Kew, so that they may be relied upon as correct.

It may seem strange that the tree has decreased in height by 2 feet since Selby wrote in 1842; but this may be accounted for by one of the following suppositions—either that the tree lost its leader after being measured by Selby, or that the height he recorded was simply a guess. The latter is hardly probable, as Loudon, who figured the tree four years previous to Selby, gives it as being then 85 feet in height,* or 5 feet less than when recorded in 1842 by

* Loudon says, "between 80 and 90 feet high." See vol. iv., page 2205, of *Arbor. et Fruti.*

Selby. That the tree may have lost its leader is by no means unlikely, as I am informed by Mr Nicholson that the extreme top is not so straight as Loudon's figure.

On this estate, where the *Laricio* has been planted pretty extensively, many fine specimens are to be seen, ranging in height from 50 to 70 feet, and with trunks girthing from 5 to 6 feet at 3 feet up. The largest specimen, which occupies a prominent position on the lawn near the castle, is 72½ feet in height, and girths, at 1 foot and 5 feet, 9 feet 4 inches and 9 feet 3 inches respectively, and has a spread of branches of 45 feet in diameter. Another fine tree, which was blown over during the early part of last year, measured as follows: The butt end was 32 inches in diameter, and at 9 feet it measured 6 feet 2 inches in circumference; 18 feet in length of the butt end was free of branches, and as straight as an arrow, and contained exactly 40 cubic feet of timber.

As a substitute for the larch in this country, this majestic tree has perhaps received a greater amount of attention from planters than any other; for while some have spoken in admiration of its noble appearance and adaptability for planting in exposed or maritime situations, others have enlarged on the qualities of its wood, and spoken of the excellent returns from this tree that might be realised by proprietors were they but wise enough to plant plenty of it. How far any or all of these views may be correct is a point which—at least, from practical experience of the tree in this country—cannot be very satisfactorily settled, and of which it would as yet be premature to speak with any great amount of confidence. Certainly, as a fast-growing ornamental tree, or for planting in exposed or maritime situations, this pine is invaluable, and at present bids fair to outrival all others, not even excepting the Austrian and Pinaster pines, to which it is in every way superior, but more especially as regards the quality of its wood. The dense growth, beautiful dark green foliage, and hardy nature of the Austrian pine we by no means wish to overlook; but in carefully weighing its merits in point of general utility with those of *P. laricio*, we feel in duty bound to throw our weight of evidence in favour of the latter tree.

Of late years this pine has become a favourite with most planters, and with none perhaps more so than the noble owner of this estate, who, seeing its value, not only as an ornamental tree, but for planting in exposed or maritime situations, caused it to be extensively used in the formation of young plantations throughout the estate. A plantation containing over 30 acres, and situated at 500 to 700

feet above sea-level, was some years ago formed with *Pinus laricio*, planted at 16 feet apart all through, the intervening spaces being filled up with larch, Scots fir, and various other forest trees for removal at an early date.

For the past half century this pine has been planted here, not only as a park or lawn tree, but generally over the estate, which has given us ample opportunities of not only testing the quality of its wood, but also of forming a pretty correct idea of its utility and value for general forest planting.

Regarding the quality of home-grown wood of *Pinus laricio*, it would, as I have before stated, be premature to speak with any amount of certainty, as few trees have attained a size at which the wood could be considered mature. We have, however, cut up several of the largest trees here, and used the timber for various purposes on the estate with very satisfactory results. When sawn into boards, the wood resembles somewhat the red deal of commerce; it is, however, more brittle, extremely resinous, tough, weighty, and the concentric rings firmly packed. It works smoothly and easily, and is, likewise, susceptible of a fine polish. A series of experiments with the timber are at present being carried out on this estate, such as for fencing posts, gates, boxes, etc.; but sufficient time has not yet elapsed since the commencement of these experiments for us to form a correct idea of the real value of the wood as grown in this country; so far, however, the results are in every way satisfactory.

For planting in exposed situations, or within the influence of the sea, this pine is excelled by none with which I am acquainted. Along the outskirts of several plantations that are fully exposed to the south-west, from which point our worst winds blow, the *Laricio* is far superior to the Scots fir, and about equal in value with the Austrian pine as a screen or shelter tree. Where the Scots fir becomes weather beaten, and, as it were, shrinking or bending from the blast, the *Laricio* stands boldly out, seeming as if to defy both wind and storm, and rearing its head far above any of the surrounding trees. This is very noticeable in several clumps and strips of trees planted nearly half-a-century ago in the park here for shelter and effect. Again, near the sea-coast this pine grows with a vigour excelled by few, and seems quite at home even within the direct influence of the salt spray; and for this reason, as well as its ornamental appearance, has been extensively used in the formation of our sea-side plantations. On the mountain side between Llandegai and Aber, at altitudes ranging from 300 to 500 feet above

sea-level, where, upwards of thirty years ago, several extensive plantations were formed, the *Pinus laricio*, although used in very limited numbers, may be seen above any of the other trees planted at the same time, and boldly facing the south-western blasts, which at times sweep along the hill sides with terrific fury.

This pine is by no means fastidious about soil; indeed, it may be seen growing luxuriantly here on all classes, from poor thin grave to deep strong loam. I have, however, always noticed its preference for deep gravelly soils, or such as are of a loose, porous nature; indeed the largest and finest specimens on this estate are growing under such circumstances.

This fact was brought forcibly under my notice at the time the large specimen mentioned above was blown down, for on examining the up-turned root it was found to be almost entirely composed of rough gravel, with a small coating of decomposed vegetable matter atop, further investigation revealing the fact that the position on which it grew was formerly a gravel pit. Several other specimens of nearly equal dimensions are growing on the same site. That the *Laricio* will succeed best on such soils is, however, not to be wondered at, when we take into consideration the long, deep-running nature of the tap root. On soft, spongy, or undrained marshy ground this pine will not succeed, these classes of soils being anything but favourable for the healthy development of the tree. Although of rapid growth the leader of *Pinus laricio* is by no means brittle, which is clearly proved by the fact of the tree seldom losing its leading shoot or becoming damaged during a storm. On this estate it is also less seldom blown down than the Austrian, but the characteristic tendency of the latter tree to form a dense, heavy branched head, which the slower formation of roots cannot support, will readily account for its being more frequently uprooted than the former. When allowed plenty of room for full development this but rarely occurs; indeed, when standing singly as a lawn or park tree, although the position be very exposed, I cannot remember having seen either of the above trees blown over—a fact clearly showing that the early and timely thinning of woodlands, in which these trees occur, is all-important.

One valuable qualification possessed by *Pinus laricio* is its immunity from the attacks of game, these pests having such an aversion to it, that even during the most severe weather, when the Austrian and other species of pine fall an easy prey, the *Laricio* is left untouched. Even in a young state, and when newly trans-

ferred from the nursery borders, at which stage most trees being fresh and tender are usually devoured, this pine is quite free from their attacks, a fact which numerous experiments made here fully corroborate. This tree is also remarkably free from the ravages of the various insects which have, more especially of late years, committed such havoc in pine woods throughout various parts of the country. I have, however, on one occasion found a diseased tree of the Corsican pine attacked by the pine beetle (*Hylurgus piniperda*).

The nursery management of *Pinus laricio* requires a great amount of care, more especially in the way of frequent transplanting, so that strong, well-rooted plants may be produced, neglect of this generally proving injurious if not fatal to the tree when planted out permanently. Usually young plants of this pine are, like *P. pinaster*, found to have but a long taproot and two or three shorter ones, and to be almost destitute of the numerous small rootlets so necessary for the successful transplanting of the tree. In the formation of a new plantation in which this pine is to be used, small bushy plants should always be chosen in preference to those of larger growth, as these will ultimately succeed better than such as have their taproot destroyed, which is usually the case when transplanted of a large size.

The Corsican pine is usually propagated from seed, which should be sown, according to the season, in March or April, on well pulverised soil of a sandy texture formed into beds about 4 feet wide. The seeds should be sown thinly but evenly over the surface, so as to allow plenty of room for the young plants developing their side branches. When the plants in the seed-bed begin to touch each other, they should at once be planted out in lines and in good soil of rather a light nature, previously dug and well broken up. The lines should be about 14 inches apart, and the young plants at a distance of 8 or 9 inches from each other, which will not only insure plenty of room for full development, but also sufficient accommodation for weeding and keeping the young plants in a clean, healthy condition. In planting the seedlings great care should be taken to spread out the rootlets to their full extent, and in a circle round the stem of the plants—a matter of much importance for their future welfare. This is, however, so frequently neglected in the nursery management of not only this but most other trees, that the above warning, combined with the following instructions for the transplanting of this pine, may be useful to those who adopt the ordinary hap-hazard method of planting young nursery stock:—

Where the plants are to be inserted in the nursery a line should be stretched along the surface, and a sloping notch taken out with a spade along both sides of the line, thus leaving the ground in the shape of a small sharp-pointed ridge. The line should then be lifted and the plants set along the ridge, spreading the roots carefully out into the notch on both sides, and covering them with loose, fine soil.

It will readily be seen that by this method the roots are in a measure trained from infancy in the position which they should occupy when they become trees; and, as they will form a complete whorl round the base of the stem, they are not only enabled to collect food from all quarters, but are much less apt to be uprooted by the wind during a storm.

If a greater amount of attention was bestowed on the nursery management of *Pinus laricio*, and frequent transplanting resorted to, we should not so often hear of the few roots formed by it, or of the difficulty usually experienced in successfully transplanting the tree.

In various other places as well as amongst our Welsh hills, the *Pinus laricio* seems to do well, for Lord Powerscourt, in his letter to the *Times* of 21st July 1883, on the "Reafforesting of Ireland," thus speaks of it:—"There is also a considerable sprinkling of *Pinus laricio*, which latter I consider to be perhaps the most valuable of the recently imported foreign conifers." Another correspondent to the same paper wrote as follows regarding *Pinus laricio*:—"This is one of the best conifers for planting on poor land in exposed situations, with a view to a permanent crop of timber. We have a quantity of it here planted out on a bleak plain, in a thin, poor, brashy soil, growing at a rapid rate, quite overtopping the larch and Scots fir; and it appears to shape itself so well for a timber-producing tree, that I believe it will prove to be the best of all the pine family yet introduced. It has other good qualities too, for hares, rabbits, and boring beetles rarely injure it. It has, however, one drawback—it transplants badly, but this may be overcome by growing it on in a nursery, and carefully shifting it every autumn until it is ready to plant out."

At Blair Athole the Corsican pine is doing well at 700 feet above sea-level, and makes as much girth and growth in that position as the Scots fir.

In conclusion, from my experience of this tree, I have every reason to believe that, in point of general utility, as well as suitability for our climate and soil, it is not excelled by any as yet introduced into Britain.

XII. *The Present State and Future Prospects of Arboriculture in North Lancashire.* By GEORGE DODDS, Overseer, Wyreside Cottage, Lancaster.

In describing the arboricultural features of the Palatine County of Lancaster, a glance at the map of England will at once convince the eye of the experienced that trees will be grown with difficulty when the maritime exposure is taken into account. Lying, as it does, along the coast of the Irish Sea, it is fully exposed to the strong westerly winds that blow therefrom. Also the extensive Bay of Morecambe adds largely to the extent of the seaboard. Still in some of the valleys and inland parts of the county trees thrive admirably.

In reporting upon a county such as Lancashire it would be impossible to give the whole county its due merit in a paper such as this, consequently I confine my remarks to the Upper or Northern Division.

The Northern Division is generally known as that portion lying north of the river Ribble, and extends from the important town of Preston to the boundaries of Cumberland, Westmoreland, and Yorkshire, and the area of this division comprehends about 650 square miles. Although the climate of Lancashire is humid, the air in the Northern Division is generally pure and salubrious. In the hilly and elevated districts on the north and eastern boundaries it is cold and piercing, but in the lower districts, shelving to the south and west, it is in general mild and genial. Severe frost is seldom experienced in the low lands, and a fall of snow is generally soon dissolved by the mildness of an atmosphere loaded with saline particles, wafted by the western winds from the Irish Sea.

The soil in the elevated parts is in general moory, heathy, and rocky. The lower portions of the sides of the hills and the valleys formed by them are commonly somewhat of the nature of holme. The flat tracts that spread at a considerable distance below them are chiefly of the loamy, clayey, or alluvial description, gravelly and mossy or peaty portions being found in all.

That Lancashire at one period had been extensively covered with trees is evident, as traces of them are found in most of the peat mosses, the remains being chiefly oak. During the reign of Henry VIII., I find the Royal Forests in Lancashire were Bowland, Wyresdale, Bleasdale, and Fulwood, out of which the Chancellor, Attorney-

General, Receiver-General, and two Auditors were entitled to deer summer and winter. These forests belonged to the Duchy of Lancaster, at that time vested in the rights of the king. No trace of these forests now remain.

Woods and Plantations.—Having given a brief outline of the county in relation to soil, climate, and situation, I will now turn to the more immediate subject of this report, and shall endeavour to give a description of some of the leading features of Arboriculture in North Lancashire. In this county, as unfortunately we find the same in many other districts, a great many proprietors only look upon their woods as mere game preserves. In many cases a man is not allowed to enter them except at certain seasons of the year, and often delaying the operations of thinning and pruning until the trees are damaged past recovery, and never can attain the object aimed at, namely, the supply of profitable timber for the benefit of the estate.

In laying out plantations in this county proprietors have of course been influenced by different motives—shelter, ornament, and sport—and in many instances the result is, that the plantations have not always been laid out to the best advantage. Nor have the trees been planted in the most suitable soils and situations, as we often see larch planted where other trees would have succeeded better.

In some districts of the county coppice woods are chiefly grown. These consist, as a rule, of oak, alder, birch, ash, and hazel, and are generally cut over from eighteen to twenty-five years of age. The principal coppice woods are in the Furness district, and are generally well grown, while in other districts little attention is paid to the coppice from the time of cutting until the crop is ready to cut again. A case came under my personal observation the other day in a wood extending to about 65 acres, mostly about fourteen years growth. Thinning of no description has been done since last cutting; the result is, that the shoots from the stools are all weakly and overdrawn, and the crop deteriorated in every way.

Fences.—The thorn hedge is very common as a fence in North Lancashire, more especially in the low-lying districts, where some very good specimens are to be seen. The management is the same as that which, I believe, is common in other counties in England, viz., when the hedge gets overgrown, which in some cases it is allowed to do for the sake of shelter, it is laid over, and at the same time still forms a fence, by cutting the stems about half way through 6 inches or so from the ground. Stakes and pegs are then driven into the line of fence to keep the layers in their place.

The cut is sloped upwards to prevent water lodging, and good sloping cuts generally produce the best and strongest shoots. When an old hedge is thin this makes a good fence, as the layers fill up the thin places, but much depends upon how the work is done to prove a success. A very pernicious system termed "pricking" has been adopted on some estates, and unfortunately has been carried out to a considerable extent to the great injury of many good thorn fences. This is done by taking some of the stronger portions of underwood and driving it into the root of the hedge to fill up gaps or weak spots. This I consider most injurious to the health of thorn hedges, as they require light and air near the ground to keep them strong and healthy when a stable fence is required. Hedges are generally planted upon dykes, or what is termed here "copes;" the dyke or cope is usually raised about 2 feet in height, with a breadth at base of 4½ feet, and 3 feet wide at top, thus giving it a batter of 9 inches on each side. Generally, a ditch is made at one or both sides of the bank, very few hedges are planted upon the level ground. In the high-lying districts of the county the ordinary stone-dyke is common.

Draining.—This is another important adjunct in arboriculture, but as a large portion of the woods in this division of Lancashire have been planted in glens and ravines between the hills, a great part of the ground has had little in the way of artificial drainage, the land having in most cases a free natural drainage. In flat and low-lying districts the ordinary system of open drains has been adopted.

Planting.—In most of the older woods, and more especially about gentlemen's residences, it is common to find the mixed system of plantation composed of oak, ash, beech, elm, Scots fir, etc. A good deal of oak is grown in some districts, but much of it is of a stunted nature, as in most cases the plantations have been laid out in narrow strips and belts. I have no doubt but at the time the plantations were formed an inducement was held out to plant oak in consequence of the demand for that class of wood, and the price it commanded. The high price obtained for bark would also recommend the planting of oak. Some of the land is well adapted for growing oak; other portions are not; but had the woods been planted in larger masses, better timber would have been grown, and the result been more satisfactory to the proprietors. On the slate formation in the neighbourhood of Coniston the larch thrives luxuriantly, and, when cut down from forty to fifty years of age, proves a very valuable

crop. In a high-lying district at the head of the Wyre Valley some planting has been done within the last few years. The soil is principally blue clay. The trees planted are larch and Scots fir, at 3 feet apart. Some of these woods are far from being satisfactory. The larch is affected with blister, aphis, etc. A great many of them are dying off, and only from eight to ten years planted, thus proving the unsuitableness of the larch upon cold, stiff, retentive clay soils. All this ground has been well drained with open drains 25 feet apart, and 30 inches deep; while in the same district, on the side of the hills, just on the boundary of the county, on a light moory soil resting upon the millstone grit, the larch attains to a good-sized tree. Another drawback to the welfare of young plantations is the rabbit pest, many proprietors having encouraged them to an enormous extent upon their estates, necessitating—in almost every case of planting—the enclosing of the whole plantation with wire-netting. This adds greatly to the outlay when it is carried out to any extent. The operation of planting is generally done by digging pits 3 to 3½ feet apart, which, on the low-lying lands, is the only suitable method; while on the moors and hills notching or slitting is generally adopted.

Thinning.—This, to my mind, is one of the most important departments in all matters connected with arboriculture, and I regret to say in how few instances I find it is properly attended to. I am aware that there are many estates in different parts of the country where woods and plantations are properly attended to; yet they are the exception to the general rule, and more especially so in North Lancashire. Thinning, except in very few instances, has received little or no attention in this part of the county, and where it has been done it has too often been carried out by men who had little or no knowledge of the management of woods, many proprietors thinking, I believe, that it would not pay the trouble,—to the great loss and ultimate deterioration of their woods. On many estates, even of considerable size, no qualified forester is kept, to whom the duty of thinning can be entrusted. It then commonly falls upon the land steward or agent of the estate, who in many instances gets the timber merchant to come and assist in the marking of trees when a thinning or fall of wood is contemplated. This system cannot be too much condemned. Naturally the merchant will have his eye upon the trees most likely to suit his purpose, little or no attention being paid to the ultimate benefit of the plantations. In all cases of thinning, and more especially when this operation has

been neglected, the utmost care and caution ought to be exercised. The great art of thinning is to do it in a gradual way, so that, as the trees increase in height, they may, just in proportion to their growth, get plenty of space for their healthy development. An important part of thinning here is clearing out the underwood, which can always be profitably disposed of, especially if it consists of ash or hazel. It can be cut with most advantage from eight to twelve years' growth. The thinnings of alder, for which there is a good demand, can always be profitably disposed of for bobbins and clog-making purposes.

Pruning.—This is a branch of forestry that one does not often see practised in this county, and in many instances, when the operation is performed, it would to my mind have been better let alone. A case of pruning a young mixed hardwood plantation (about twenty years planted) came under my observation last spring. In giving the plantation a partial thinning, all strong branches growing on the stems of the trees left standing were ruthlessly knocked off with the axe by the workmen in the course of cutting the trees marked. The pruning was done from 8 up to 10 feet high. This system was practised by a man who has had charge of woods upon a large estate upwards of forty years. One also observes here and there attempts to prune hedge-row trees, and often the trees are more disfigured than benefited by the operation.

Hedge-row Trees.—Generally speaking, the hedge-row trees of this county are not well grown, although they form a very prominent feature in the landscape of the country. In many instances I find the trees unsuited to the position in which they are planted. Many of them are miserable abortions, unprofitable to the proprietor, and a nuisance to the farmer, more especially in tillage districts, where the farmers have to continually wage war against them. The trees best suited for hedge-rows ought to be of an upright habit of growth, such as the English elm, sycamore, oak, lime, sweet chestnut, etc., and, when managed with skill and taste, in the way of planting and pruning, they have a most important influence on both stock and crops, and add immensely to the beauty of the landscape. In no case should the ash be planted as a hedge-row tree, but here we find it in quite common use.

Cutting Down and Disposing of Timber.—When a quantity of timber is sold standing, as practised on some estates, the felling is generally done by the purchaser's men. This is a system that I do not approve of, as contract men are never so careful in saving the

trees left standing as the proprietor's men. Cutting down timber previous to sale is a common practice. Classing and arranging the timber in lots and selling by auction is also practised upon some estates, and, in most cases, this I consider the most satisfactory way for disposing of a mixed lot of timber. In selling by measurement a tree is generally measured up to where it will girth six inches on the side, no allowance for bark being made on any class of timber. Small pitwood is often sold by lineal measure, and by this system much time is saved in measuring.

Demand for Timber in the County.—When one looks at the quantity of timber annually imported into the mining districts of Lancashire, one would naturally imagine that the growing of timber trees would have formed a more important item in the management of the estates in this county than it has done, and that landed proprietors would ere this have largely increased the acreage of their woodlands. I will now give a list of the principal kinds of wood most in demand, and the prices that I have received for wood this season. The prices quoted are for timber lying in the plantations, two miles from a railway station (alder excepted, as the cloggers prepare all their soles in the wood), the principal markets for the wood ranging from twenty to forty miles on the railway. The disastrous gales of last year have had a serious effect in lowering the price of timber in this county as well as others. Oak that used to sell at 2s. 6d. per foot only draws 1s. to 1s. 3d. per foot. Scots fir and spruce are unsaleable at any price, and in many woods that are in any way difficult of access, I believe a great deal of that class of timber will be allowed to lie and rot.

Description of Timber.	Age.	Price per Foot.	Observations.
Ash,	40 years.	1s. 3d. to 1s. 6d.	Fair demand if clean for handle wood.
Alder,	35 ,,	10d. to 1s.	Always in demand for clogging and bobbin wood.
Beech,	65 ,,	8d.	Not much in demand.
Elm,	70 ,,	9d. to 1s.	Used for wheel naves.
Oak,	70 ,,	1s. to 1s. 3d.	
Larch,	40 ,,	8d.	
Scots Fir,	...	...	No demand at present.
Spruce,	...	...	No demand at present.
Pitwood,	...	15s. per ton.	

Bark.—Oak bark has sold this season from £4, 15s. to £5 per

ton; stripping and drying costing from 45s. to 50s. per ton, according to the size of trees felled.

Ornamental Arboriculture.—That there has been and still is a considerable taste for planting ornamental trees and shrubs, is proved by the varied collections to be seen at different places, chiefly Holker Hall, Parkhill, Quermore Park, Forton, Scorton, Wyreside, Ashton Hall, and many others, where the *Araucaria imbricata*, *Cupressus Lawsoniana*, *Thujopis borealis*, *Picea Nordmanniana*, *Pinus cembra*, *Thuja Lobbi*, and many others, all grow luxuriantly, and seem to suit the soil and climate of this county. It would prove very interesting to have a correct detail of all the trees grown upon different estates, both evergreen and deciduous, their variety, height, age, nature of soil, etc., but that would quite exceed the limits of a paper such as this.

Future Prospects.—I have now noticed a few of the most prominent features of arboriculture in North Lancashire, and to the observant arboriculturist it will at once be seen that much requires to be done to put it upon an equal footing with some of the other counties in England. I shall now offer a few remarks upon the future prospects of arboriculture in the district, which must necessarily be speculative to a large extent. I may add that there is plenty of room for extending the acreage and improving the management of woodland property.

There is much of the land, more especially in the hilly portions, yielding a very small rent to the proprietor, and were plantations judiciously formed upon it, not only would it yield a better rental, but the woods affording shelter to the adjacent land, both stock and crop, would be greatly benefited. Planting on any of the high altitudes of the county has not been much practised, but patches of trees here and there show that if they had been planted in larger masses, much better results would have been obtained. The fact that such plantations do exist is evident proof that on a larger and broader scale they would succeed in a greater degree, as it is a well-known fact that the greater the extent of land under a crop of trees the better will they succeed in it. Narrow belts and thin clumps planted on exposed situations are, comparatively speaking, worthless as shelter.

In some of the agricultural districts there is always a tendency to speak of land occupied by plantations as so much ground lying waste. This no doubt is from a want of due consideration of the matter, agriculturists losing sight of the benefits conferred upon

them by existing plantations in the amelioration of the climate. Previous to planting his land a proprietor will always consider what return he is to get from the land so occupied. Arguments in favour of reclaiming waste land by planting have been pressed upon proprietors for many years in the public press and otherwise, and although much has been done much more yet remains to be done. It is calculated that there are 80,000 acres of shore land in Lancashire, of which it is estimated that 40,000 acres are reclaimable. Where could we find a wider field for experiment, and at the same time get a better test for all timber trees that would stand the sea breeze? This of course would be a consideration for Government. The length of time that must necessarily elapse before any return is received for money laid out in planting forms the chief objection to its being more generally carried out, and I am much afraid the prices we are receiving at the present time for timber are far from encouraging landed proprietors to invest largely in planting; but as we are constantly hearing of the timber resources of America failing, I hope to see landed proprietors aroused to the subject of planting. And with a special Parliamentary Committee to inquire into the state and condition of forestry in this country, I expect to see the planting and management of our woodlands receiving more attention in the future than they have received in the past, both by landed proprietors and the nation at large.

XIII. *Report on a Visit in September 1881 to the Scottish and English Forests by Professors and Students from the Forest School, Nancy, France.* By M. Boppe, Inspector of French Forests.[1]

The total area of Scotland is about 20,000,000 acres, hardly one quarter of which may be reckoned as arable, forest, or pasture land, the remainder being occupied by lakes, rivers, peat-mosses, moorlands, bare rocks, and mountains. It is surprising, then, to find that against such a vast area of uncultivated ground only 734,490 acres, according to the official returns of 1872, are classed as woodlands.

There is every reason to suppose that, at a remote period, both the Highlands and Lowlands of Scotland were covered by dense forests, which were successfully destroyed by the fire and steel of conquerors and during the anarchy existing under the old feudal system, as well as by the fearful storms which at almost regular intervals sweep over certain districts. So complete, indeed, was this devastation, that, in 1707, all that remained of the grand old Caledonian forests were a few shreds, and those in a most deplorable condition.

From the union of the two kingdoms dates a period of political calm, during which, time and the marvellous timber-producing properties of the soil and climate would have done much to repair the ruin, had not the sheep, arch-enemy of all forest vegetation, been allowed to retain his footing in the forests.

The noblemen and great landed proprietors of Scotland at last felt the necessity of doing something to restore the parks and woodlands in the immediate vicinity of their mansions, and by the introduction of plantations to vary the sombre monotony of the boundless heather. It was also necessary on these bare moors, where grazing and shooting form the main sources of revenue, to furnish shelter for the cattle, sheep, and deer. Their example was soon followed by the smaller proprietors, and, under the wise patronage of the "Select Society" of Edinburgh, founded in 1754, the area of forest land augmented rapidly, so that in 1812 Scotland

[1] This Report has been, by inadvertence, omitted from the *Transactions* till this date; but being of special importance at the present time the Council have agreed to insert it.

possessed, besides 500,000 acres of natural forest, about 400,000 acres of plantations.

The year 1815 marks a pause in the work of replanting which had been so vigorously begun. We do not pretend to enter here into the various causes which led to this economical phenomenon, but it is certain that the laws of 1636, on the constitution of landed properties in Scotland, exercised a baneful influence on the rational cultivation of the soil. The Scottish Parliament in vain sought to counteract the Draconian regulations of these laws, the principal effect of which was to cause the proprietors to look on themselves as only life tenants of the entailed estates, and consequently to take but a very slight interest in the improvement of the soil and the augmentation of its pecuniary value.

From the moment the planting ceased the area of woodland diminished, and necessarily so, for in any forest where sheep have free entrance the removal of a tree, whether by the axe of the wood-cutter or by the violence of the wind, causes an empty space which can only be refilled by resorting to artificial means. It is thus that the returns of 1872, as compared with those of 1812, show a diminution of some 200,000 acres in the area of forest land in Scotland. Whether it was a portion of the old natural forests or the newly planted ones that had disappeared during this period of 60 years, the documents extant do not show. There is, however, good reason to suppose that both suffered equally in this respect. For, on the one hand, the construction of the Highland Railway necessitated the employment of a large number of sleepers, which could be procured from the woods of from 50 to 80 years of age, along the line of route; and, on the other hand, the increased facilities of transport, and the scarcity of wood in England, gave an unexpected value to certain tracts covered with birch, and so tempted many of the proprietors to cut down the old forests composed of this species.

In 1870 the work of replanting seems to have recommenced with increased ardour, and on all sides may be seen young plantations vigorously striving to fill up the gap which separates them from those of half a century's standing.

Such, in a few words, is a brief outline of the history of the forests which we have had the good fortune to visit, under the guidance of our excellent friend, Colonel Pearson. Thanks to the kind forethought of the authorities at the India Office, and to the hearty welcome which we everywhere received from

the great landowners and their agents, our flying visit was accomplished in a most agreeable and instructive manner. We eagerly seize this opportunity of offering to all concerned with it our sincere and hearty thanks. We would fain also express to the eminent personages who did us the honour of receiving us so graciously, that we accepted their kind marks of attention as being addressed, not only to ourselves, but also to the French Government and the Forest School at Nancy, which year by year, since 1868, has offered to the English Students, without any distinction of nationality, the advantages of a forest education.

Before proceeding to a description of our tour, it will perhaps render the narrative more intelligible if we give a brief sketch of the country we visited, its general aspect, and natural resources.

From a forest point of view, Scotland may be divided into two distinct regions, by an imaginary line drawn from Perth, on the Firth of Tay, to Greenock, on the estuary of the Clyde. To the south of this line we find the Lowlands, a country which agriculture and manufactures have combined to render one of the richest in the world. The economic situation of this wealthy district is as prosperous as possible, and the thoroughly developed system of high farming which is there employed leaves but little room for forest cultivation. The Lowlands are bounded on the south by the Cheviot Hills, which afford excellent sheep-walks. To the north of this line lie the Highlands, intersected in all directions by the far-stretching chain of the Grampians, whose rugged nature gives to the country an aspect not unlike that of the western coast of the Scandinavian peninsula. One would imagine that at some earlier geological period immense polar glaciers, flowing over the solidified North Sea, traversed the whole of the north of Scotland, polishing on their way the mountain sides, excavating the lake beds, and breaking off abruptly the cliffs surrounding the coast. The culture of cereals is here confined to a few favoured localities, situated near the mouths of the rivers or on the low-lying ground bordering the sea, where the glacial deposits constitute an excellent soil. The rest of the country is wholly occupied by water and heather, and thus out of the 13,000,000 acres which this region comprises, only 1,600,000 (or less than one-eighth) are classed as arable, forest, and pasture lands. If out of the remaining 11,000,000 acres of unproductive land we allow a half for the lakes, bare ridges, and sterile mountain tops, there will still remain 5,000,000 acres capable of furnishing valuable timber forests. Here then is a

problem for British economists, and a vast field for enterprise and capital.

Highland Forests.—In the Highlands, to which we principally directed our attention, the districts around Perth, Elgin, and Inverness are those in which the most extensive forests are to be found. These three counties together contain about 247,700 acres of forest, and being well served by the Highland Railway system, these are easier to visit than any of the other Scotch forests. Starting from Perth, we made our way across the Highlands, visiting *en route* the towns of Dunkeld, Blair Athole, Aviemore, Grantown, Forres, Inverness, and Beauly. We were thus enabled not only to make an inspection of some of the finest forests in Scotland, but at the same time to obtain a fair idea of the general aspect of the country. The punctuality and precision, so thoroughly characteristic of Englishmen, with which all the details of our journey were arranged by Colonel Pearson, added to the hearty reception we met with at every turn, enabled us, in the short time at our disposal, to thoroughly inspect more than 100,000 acres of every description of forest, under ever-varying physical and geological conditions. Everywhere, both at a few feet above the sea-level and on the sides of mountains at a height of 2500 feet, in the sands of Forres, and in the schists, red sandstones, granites, and gneiss of the interior, we were struck by the wonderful aptitude of the soil to forest vegetation, favoured as it is by a regular climate and the constant humidity of the atmosphere.

In the low-lying districts, at an altitude of from 250 to 300 feet, we found growing, both singly along the roadside and collectively in the forests, magnificent specimens of oak, maple, elm, ash, beech, and lime, which, by the vigour of their growth and the rich colouring of their foliage, bore testimony to the favourable conditions of soil and climate under which they grew. We were struck with admiration in beholding the colossal trees of every description forming the avenues at Scone, Dunkeld, Blair Athole, and Darnaway. It was near the first of these places that the venerable father of Scottish forestry, Mr M'Corquodale, showed us, with legitimate pride, a small oak forest of about 400 acres, which, 60 years before, he had himself assisted to plant.[1] In this forest

[1] Mr M'Corquodale corrected this statement in the *Journal of Forestry*, Vol. VI., p. 60, 1883; and said that the error had crept in because the interpreter had not translated his remarks correctly. The plantation was formed in 1808, and was therefore 73 years old.

the trees were standing about 24 to 30 feet apart, and their diameters measured from 12 to 18 inches, whilst their magnificent tops formed a perfect canopy of leaves above the bright rhododendrons, in which colonies of young pheasants found a home. In the spring time this ought indeed to be a fairy-like spot. But, independently of this undergrowth, which is, after all, only suitable for the wealthy few, we cannot help thinking that a more careful study of this superb forest would go far towards clearing up some of the doubts which have always surrounded the difficult question of the cultivation of forests composed solely of oak.

The mountain vegetation commences at about 400 feet above the level of the sea; beyond this we find ourselves in the domains of the Scots fir, the larch, and the birch.

In selecting the Scots fir as the tree to be cultivated before all others in these regions, the promoters of forest plantation during the latter half of the past century showed no mean proof of their thorough appreciation of the natural requirements of the soil and climate of the Highlands, for not only have they ensured the success of their operations, but they have traced out the best line of action for their successors.

Equally fortunate were they in their endeavour to introduce the larch into Scotland; transported from the ice-bound summits of the Alps to a country where the climate is tempered by the softening influence of the Gulf Stream, this tree does not appear to have suffered to any material extent by so sudden a change of latitude.

When, in 1737, the Duke of Athole brought home amongst his baggage, as a kind of remembrance of his travels in the Tyrol, the seeds which were sown in his park, and from which sprung the first larches in Scotland, he rendered a most valuable service to his country.

From a forest point of view, the results obtained by the cultivation of these two species (Scots fir and larch) are truly marvellous. Any one who has seen the beautiful larch forests planted in 1815 on the banks of Loch Ordie, and the vast stretches of Scots fir covering the flanks of the Bruarwood mountain, cannot fail to admit that the question of the replanting of the Scottish Highlands is practically answered.

The absence of the beech from all the forests of any standing is easily accounted for by the fact that it is only quite recently that the timber of this tree has become of any value for industrial purposes. For many cultural reasons, however, the beech is a tree of the highest importance, and we should strongly recommend its

introduction into all future plantations; and it is, moreover, as much indigenous as the Scots fir and birch. In many cases even it might with great advantage be substituted for this latter, or, better still, mixed with it.

Considering, too, the wonderful success that has attended the introduction of the larch, we think that a similar attempt might be made to acclimatise the *Pinus montana* in the peat mosses. These immense sponges, so to speak, which cover sometimes entire districts, discharge their dark-coloured waters into all the streams, and give to the lakes and rivers of Scotland that sombre tint which is so peculiar to them. The fuel which they afford is of very second-rate quality; and supposing that half the surface was converted into plantations, there would still be enough peat left to keep going all the whisky-stills on the country-side.

As foresters of the Continental school, accustomed to live among forests regularly managed, and having for their sole object the production of timber, we had no little difficulty in understanding the widely different motives which actuate forest cultivation in this country. Everywhere we found the forests fenced in on all sides with walls and hedges; and, as a matter of fact, the forester or agent generally carries the keys of the gates in his pocket. We learnt that these costly enclosures were erected, not for the purpose of keeping out the cattle and deer, as in the Jura, but for the purpose of keeping them in: it appeared to us like shutting up the wolf in the sheepfold.

We were also struck by the monotonous regularity in the height and age of the trees—unmistakable sign of their artificial origin and want of methodical management. The forest, here left to its own devices, continues growing just as the hand of man has planted it; the undergrowth is constantly grazed down by the sheep and cattle, and nature, in spite of the immense resources at her disposal, is quite powerless to modify the work of the planter, or repair the errors committed by woodcutters.

When, under such circumstances, the time arrives for the trees to be cut down, or should they be uprooted by a hurricane, the forest disappears in its entirety, owing to the total want of young growth, which is necessary as a link between the old forest and the new one which ought to be created. Such, at least, appears to us to be the case in all the forests that we visited in the valley of the Tay and its tributaries, and further north, near the foot of Cairngorm.

Not far from a mansion to which are attached some of the pleasantest recollections of our tour, we saw the remains of a noble

forest, which some twenty years ago had been cut down and converted into railway sleepers. The sight of the huge stumps, blackened by time, with their gnarled roots twisting themselves over the ground, gave us the idea of some vast charnel-house. This scene of utter ruin was indeed a sad spectacle, though the present proprietor is doing his best to again cover his estate with timber; with a better system he might have been spared both time and expense. It is easy in Scotland to perpetuate a forest by natural means, and of this a practical proof was given us in two forests which we visited; the one near Grantown, in Strathspey, the other at Beauly. In these the results obtained under the skilful and intelligent direction of the gentlemen who manage these forests for their employers form a striking example of what may be done in the way of reproducing forests by natural means. In fact, nothing had been neglected which even the most critical forester could desire; the gradation of age was here complete, and the reservation of specially vigorous trees, of known pedigree, duly carried out.

The *modus operandi* here pursued consists simply in the exclusion of the sheep and deer, in the judicious thinning out of the growing crop, and in the removal of the mature seed-bearing trees, by successive fellings, as the young forest grows up and acquires more vigour.

Nevertheless, we would not have it be supposed that the sheep need be absolutely debarred from all grazing in the forest; it is only in those portions where the undergrowth is very young that the damage caused is irreparable. We feel convinced that if, every year, certain portions of the forest best capable of supporting it were marked out for grazing, the quality of the pasturage would be greatly improved, and the heather would quickly disappear under the cover.

It is an established fact, beyond all contradiction, that on any soil, whatever its geological origin, a complete covering of forest vegetation will kill the heather as soon as the trees reach the age of between 30 and 40 years. Suppose then that 120 years be the term fixed for the existence of the trees in any portion of the forest, and that the trees of 100 years of age and over are reserved, there would still be one-half of the forest always open to the sheep, and the other closed. But, at the same time, it is certain that this open half, owing to its superior quality, will furnish pasturage for at least twice as many head of cattle or sheep as the same quantity of moorland.

Although, under ordinary conditions, the regeneration of a forest will be sufficiently assured by the exercise of a discreet control over the grazing, something more than this must be done if it is desired to turn the land to the best possible account. It is therefore a matter of regret that nothing has yet been done to place forest management in Scotland on a sound economic basis.

The productive powers of the soil and of the climate have been made use of by able and intelligent planters, who have thereby enabled nature herself to accumulate a considerable store of timber; but all this wealth is exposed to the carelessness of some and to the ignorance of others, until the hand of a forester manages it properly and places it on the only sound economic principle of all agricultural and forest property, *a constant annual revenue and a constant improvement in production.*

It would certainly not be fair to hold the Scottish foresters responsible for the present regrettable state of affairs, for, though they have for the most part admitted the inefficiency of the present system, they are powerless to effect any improvement so long as the landowners and general public have not learnt to appreciate the manifold advantages to be derived from a regular and methodical management. They have to struggle against many adverse interests and hindrances, such as grazing and shooting interests, questions of routine, pecuniary exigencies, and the fancies of sportsmen from all parts of the world.[1]

In wishing Scotland, then, a hearty farewell, we venture to predict for her forests a great and prosperous future. It does not need that one should be a very great prophet to predict this for a country where the oak and beech, the Scots fir and larch, flourish with equal vigour, and where the *Abies Douglasii*, *Abies nobilis*, and *Abies Menziesii*, the *Sequoia*, and the cedar, form mighty trees, in company with the *Araucaria* and various exotic shrubs, which only languish miserably under the climate of Paris.

Before leaving this country, however, we would fain add a word of advice, for the moment appears to us a propitious one for deciding on the future welfare of the forests, which, owing to the rapidly increasing value of timber, runs great risk of being compromised. Ordinary fir timber now fetches 8d. per cubic foot, larch is worth nearly double that amount. We ourselves visited a forest of Scots fir which, at this rate, would be worth £120 an acre,

[1] A deer run, over unproductive land, has just been let to an American for nine years, at the fabulous rent of £10,000 per annum.

and another of larch worth considerably more ; whilst a third forest of 1600 acres, composed of Scots fir, was purchased a few years ago for £52,000, or only about £30 an acre. The plantations on the Culbin Sands, near Forres, would readily find buyers at £50 an acre at the age of forty-five to fifty years. The very day we were at Grantown, the agent for the Strathspey forests concluded a bargain to furnish birchwood to the amount of £2000.

All these figures are fraught with extreme significance for the future, and the large forest owners of Scotland will do well to pause before allowing their forests to be "over-worked." We would recall to their recollection the old fable of the goose that laid the golden eggs.

No doubt, people are often frightened by the long names and big words they find in treatises on scientific forest management, but they may very well neglect the text if only they will adopt some of the principles which they contain. Let the owner of a forest, after having made a careful and detailed inspection of it, divide it off into blocks or compartments so arranged that they should be uniform as regards conditions of soil and of planting, and then proceed to count and measure all the trees of 3 feet girth and upwards, classing them in categories according to their diameter. He should then open a debit and credit account for each compartment, placing on the debit side the actual volume of the standing crop, and on the credit side the volume of timber removed at each successive felling. This register should always be consulted before undertaking any forest operation, and when the annual fellings fall due, it will show which compartments can best support the withdrawal of timber, and which require to be left untouched. Moreover, the balance sheet will render an exact account, favourable or otherwise, of the condition of the forest.

Ten years of such systematic treatment would form in itself the basis of a regular forest-working plan, and the doctor's prescription would no longer frighten the patient with its long words.

Our programme, however, was not yet complete, and fresh excursions awaited us in England. It took us only four days to reach Windsor Forest from Inverness, passing by the Caledonian Canal, and halting at Oban (from whence we visited Staffa and Iona) and Edinburgh, whence we took the train to London.

Windsor Forest.—Even with a four-in-hand and the best of drivers, it would be impossible to see Windsor Forest in such a short time as we had at our disposal.

The history of that noble park has been published in a splendid volume by the late Surveyor; but the history of Windsor is, so to say, a repetition of the history of England herself. If we follow all the phases in the development of this park, where, since the time of William the Conqueror, each sovereign in turn has given his name to some remarkable tree, Windsor Park may with justice be called the Westminster Abbey of British monumental trees; its history is one which belongs as much to archæology as it does to sylviculture, while in it the beautiful deer are almost as numerous as the trees themselves.

Nevertheless, the practical forester may rest assured that, although the first place is here given to art and beauty, he will still be able to find much to interest and instruct him. Windsor Park is indeed one of the most magnificent fields for the study of forest botany that even the wildest imagination could conjure up. Here may be seen, growing singly or collectively in clumps, specimens of all the finest trees, native or exotic, which exist in Great Britain; and, since care has been taken to keep an exact record of the age and origin of each plantation, the forester would be enabled to follow out in detail studies of the highest interest and importance regarding the growth of the principal forest species. It would be more difficult to do the same with regard to their longevity; for one is led to think, in looking at some of them, that in this hallowed ground trees never die of old age. One sees in these relics of the past that religious respect for things so characteristic of Englishmen, when even the most violent revolutions could pass over the country, and yet leave these monuments and these trees intact.

The Surveyor of Windsor Park, who is by turn a forest officer, an organiser of shooting parties, a director of the royal workshops, and conservator of a museum of antiquities, can, in consequence, have but little time to devote himself to sylviculture, unless it be to prepare the iron armour intended to preserve the veterans of the forest in their struggle against the elements, or to prop up with crutches some invalid deprived of a limb by a recent gale.

Having come all the way from Scotland to Windsor, we were not to be alarmed by the journey from there to the New Forest, for a few hours sufficed to carry us to Southampton.

New Forest.—As old as Windsor Park itself, the New Forest has not had the good fortune to be the dependence of a royal residence. The barrenness and poverty of the soil has sufficed to preserve it from being plundered even at an epoch when land was valued more

for its extent than its fertility. But, on the other hand, this very fact attracted a poor and necessitous population to settle in and around the forest, who during long ages have been accustomed to derive a precarious existence from it, and by careless abuses have threatened it with certain ruin. For many centuries the New Forest has thus been a prey to commoners, who use up its resources without either method or control. One may see there the steady onward progress which is made by the heather; and although it is not perhaps so quick under the feet of the almost wild ponies and cattle as under those of the sheep, yet it is none the less sure.

The sole remedy for this state of things was to restrict the commoners to certain defined localities, and that could only be done by sacrificing a portion of the forest to save the rest. This is, in fact, what was done about twenty years ago; but the sacrifice has indeed been a heavy one, for the reservation of some 14,000 acres has cost the abandonment of 49,000 more. The part which has been freed, however, is sufficiently extensive to constitute some day a respectable forest, whilst the part given up is hurrying to its destruction in a manner deplorable to behold, and before very long there will be nothing left but a worthless barren heath.

It is not, however, in twenty years that a forest so badly used as the New Forest can be restored. The first thing to be done was to put the soil in good order, and then to plant some of the vast stretches of heather with firs. Of late years the forest officers have sought, by excluding the cattle, to bring about the natural reproduction of some portions hitherto abandoned to pasturage. But with whatever care these operations may be carried out, at least fifty years must elapse before they can resort to systematic fellings, with a view to furnishing a regular revenue.

At present, contiguous portions of the forest often present the most curious contrasts. On one hand we see young firs and oaks growing side by side; in another place a forest of pure oak, languishing among chestnuts; and in a third, plantations of fir and beech, indicating by the vigour of their vegetation, and their healthy appearance, that it is on them that the future of the forest ought to depend. Further on, there is a valley filled with aged beeches, whose weird forms gave an almost supernatural aspect to the spot; we almost expected to see the ghost of William Rufus pursuing that of Walter Tyrrell through the haunted forest.

Without contesting the marvellous beauty of some parts of the New Forest, so dear to artists and lovers of nature, we are bound

to say that before long it will *not be here* that a professor of sylviculture, desirous of teaching his science, will choose to pitch his tent.

Forest of Dean.—On our return to Lyndhurst, after the excursion in the New Forest, there remained but three days at our disposal before our duties necessitated our return to France. These were employed in visiting the Forest of Dean.

The present Forest of Dean occupies the site of the old forest of the same name, which formerly covered the whole of the plateau between the estuary of the Severn and the valley of the Wye. ("Dean," "dên," signifies "forest" in the old Celtic language.) The old forest has disappeared within the last few centuries, owing, perhaps, to the demand for charcoal and mine-props for the local industries; if, however, we were not afraid of being accused of being prejudiced, we might say that unrestricted pasturage may have had something to do with the disappearance. It is on these ruins that the new Forest of Dean has been created; in less than a century more than 16,000 acres of the original 22,000 have been replanted. The older plantations are generally of pure oak; the beeches, chestnuts, and birches form but a small percentage of the trees. Scots fir, spruce fir, and larch are generally only found in the plantations made during the last thirty years, or in bad peaty portions. The state of vegetation is generally good, varying, however, with the quality of the soil, but indicating in every point the artificial nature of the forest.

We may take this opportunity of remarking that a plantation of "broad-leaved" trees (oak, beech, etc.) takes a much longer time to establish itself than one of "needle-leaved" trees (conifers, Scots fir, larch, etc.). In Scotland we saw the most magnificent plantations of larch and fir, whilst in the Forest of Dean the plantations of oak were always more or less dwarfed in appearance. The cause of this is, that oaks furnish the soil with much less vegetable manure than the coniferous trees; and again, in an oak plantation there is a marked absence of undershrubs and spontaneous ground vegetation, which, by their organic remains, tend to increase and improve the surface soil. It is rare, also, that a plantation of oaks, on a soil which has been long unoccupied by forest vegetation, and is but moderate in quality, succeeds well during the first generation; it is only at the second generation that the trees acquire their normal development.

At present, while the trees are yet in their youth, the only cul-

tural operations that can be undertaken are the periodical "thinnings," and these are here conducted with great skill. There is no doubt, however, a great future in store for the Forest of Dean, thanks to the workmanlike manner in which it is managed, and to the laws regulating the pasturage, which date back to the time of Charles I.

We were not able to suppress a certain vague feeling of sadness in wandering through these endless plantations, rendered so dreary and monotonous by the total absence of that undergrowth which seems to inspire the woods with freshness and life ; and it was with a sense of great relief that we emerged from them, and entered into a well-managed forest composed of standard oaks surmounting coppice-wood.

This forest, comprising about 3400 acres, was formerly the property of Lord Gage, and was purchased by the Crown with a view to presenting it to the Duke of Wellington. It is composed of pure oak, and for more than a hundred years the coppice has been cut every eighteen years. We might add that the reserved trees form the staple element in this forest, for the coppice forms but a small proportion of the standing crop. These reserves, varying in age from twenty to a hundred years, are in an excellent state of vegetation, and number about eighty trees to the acre. The largest trees are about 4 or 5 feet in girth, and from 25 to 35 feet in height of stem. It would be a great pity to cut them until they have attained at least double their present age. This forest would form an excellent field for the study of the treatment of standard oaks.

In such a forest, where the soil is so exceptionally fertile, it might be possible to find a solution to the oft-discussed problem of obtaining the maximum production in quality and quantity from a forest of oak. This was, at least, the impression we carried away with us as we turned our faces homewards.

Forest School in Great Britain.—We had barely sufficient time, on our arrival in London, to pay our respects to the authorities at the India Office, when we were asked by Sir Louis Mallet to place on record the observations which we have now the honour to submit, and to state whether, in our opinion, the immediate foundation of a Forest School in Great Britain is possible. In order to reply to this question, it was necessary for us, even at the risk of our narrative being found tedious, to enter into a somewhat detailed account of the Scottish and English forests.

Were it only for the purpose of replanting the five or six millions

of moor and waste land which cover one-third of the Highlands, we should consider there was a sufficient reason for the formation of such a school. The question, however, must be studied on broader grounds.

Considering the present depressed state of agriculture all over Europe, it becomes more and more necessary to endeavour to draw the greatest possible advantage from the land, and, by properly adapting a different vegetation to different soils, to seek to obtain, through the medium of the enormous capital which the present generation can command, the maximum production from a minimum area. It is thus that the forests are called upon to play an important part in the immediate future, and the farmer will henceforth find a powerful auxiliary in the forester.

After making every allowance for the great fertility of the soil in Great Britain, we feel certain that in many districts more than one of the forests which were cleared some time back would now be jealously preserved by the same proprietors who formerly cut them down to satisfy their pressing wants.

It must also be borne in mind that the British Empire is not confined to Great Britain and Ireland, and that, by reason of her immense possessions, England is perhaps, of all nations in the world, the one most richly endowed with valuable timber forests. It is by hundreds of millions of acres that we may reckon the forests of Canada, India, Australia, New Zealand, and Cape Colony, not to speak of those in the West Indies and Borneo.[1] All these natural sources of wealth are worked by British enterprise and British capital; and, consequent on the present wonderful development of commerce throughout the globe, it is a matter of importance to every civilised nation that this vast accumulation of forest riches should not fall into the hands of ignorant persons, or be squandered away regardless of the future.

For these reasons the establishment of a Forest School in England becomes a matter of primary importance.

Necessity for a Reserved Forest.—The science of forestry is, however, a science of observation, based upon facts which must be studied both from a practical and theoretical point of view. It is therefore absolutely necessary that a Forest School should have attached to it a forest which has for some time past been under scientific management, serving, so to speak, as a natural laboratory

[1] The total extent of the forests in the British possessions is estimated at 340,000,000 acres.

for experiments, and without which the best theoretical teaching in the world would be of no avail. This is especially the case in England, where the young men, by reason of their national character and their mode of education, are accustomed to pay more attention to facts than to theories: here the teacher of a technical profession, resting solely on theories, would command very few disciples.

It is, therefore, a matter of regret that, among all the forests visited by us in our travels, there is not a single one suitable for the teaching of sylviculture on that broad basis so essential when the pupils are called upon to apply it in all quarters of the globe. In England, as in Scotland, all the woodlands may be arranged in two categories—the one containing plantations too young, recently created by the hand of man, the other containing plantations too old, or too much overworked, to be useful for the purpose; nowhere did we see a high timber forest formed of really mature trees.

Natural Forest required.—Moreover, a plantation must always be incomplete as a field of study, and especially for persons who will generally have to deal with natural forests. Nature, ever prodigal of her bounties, if left to herself, scatters them broadcast without any regard for the particular wants and requirements of man. It is then the work of the forester to control this generous prodigality, and, by careful selection, to concentrate her fertilising powers on such trees as are best adapted to meet the general demand. In the case of a plantation there is no need for this interference; here, natural selection, the struggle for supremacy amongst the different species, and even art herself, can play but a very insignificant part in the various phases of its existence.

In a forest, then, of this nature it would only be possible to apply a very limited number of the principles of sylviculture.

A practical Englishman will have no difficulty in understanding our meaning.

It is not to be supposed, however, that the foundation of a Forest School is at present an impossibility; for, while leaving the question of time and place to be settled hereafter, it would be advisable to at once decide, in principle, on its creation. Such a decision is the only mode of arriving at its foundation. It is necessary, also, to take measures for preparing the public mind to regard the science of sylviculture as an additional means of developing the national resources, and to take steps for the gradual creation of accessory forests.

Under Control of Forest Officers.—This accessory forest must necessarily be incomplete at first, but would be perfected in time; but the essential point is that it should be placed under the absolute control of the officers of the school. This can only be done by choosing a State forest. If it should be considered desirable, also, in order to render the teaching more complete, the State ought to purchase or lease in Scotland a forest suitable for the purpose.

Professors of Forest Economy.—We would also suggest the founding of professorships of "Forest Economy" at two of the great public seats of technical instruction. One of these might be instituted at Cooper's Hill for England, the other at Edinburgh for Scotland.

The professors should be selected from among the young men who have received a thorough forest education on the Continent, and have had eight or ten years' practical experience in India. They should publish from time to time a series of articles in the leading agricultural and forest journals, in order to influence the landowners in favour of a systematic management of their woodlands, and to prove to them that uncontrolled pasturage is the certain destruction of forests, and that, in the long run, the timber furnished by forest land is of greater value than pasturage or game.

The establishment of a course of sylviculture at Cooper's Hill would have the great advantage of giving to the young engineers a rudimentary knowledge of a science which cannot fail to be useful to them in their after career. It would, perhaps, also be possible by this means to modify the present method of recruiting the Indian Forest Service, by offering to the students at this excellent institution a certain number of appointments in that service.

The course of instruction afforded at Cooper's Hill would then comprise all the essential parts of the education of a forester, and it would only be necessary to supplement it by sending the selected students for one year to a Continental school, where they would have the opportunity of perfecting themselves in the practical details of forest culture. After this, it would be advisable for them, accompanied by their English professor, to complete their training by making a tour of inspection in some of the mountain forests of France, Germany, and Austria. So prepared, the young men would be perfectly capable of undertaking forest work in any portion of the Indian Empire.

Recommendations.—In conclusion, we beg to submit the following recommendations:

1*st.* That a National Forest School be founded in Great Britain.
2*nd.* That Professorships of Sylviculture be instituted at Cooper's Hill and at Edinburgh.

Such are the conclusions at which we, in conjunction with our travelling companions, Messrs Reuss and Bartet, have arrived, and we feel that an apology is due for their length. This is really due to the excessive courtesy of our hosts, who, jealous of the success of Jules Verne's hero, who made the tour of the world in eighty days, were determined to make us traverse, in less than three weeks, more than 300,000 acres of forest land situated in the most opposite parts of Great Britain.

XIV. *The Formation and Management of Game Coverts.* By Angus D. Webster, Forester, Penrhyn Castle, Bangor, Wales.

When we consider that on not a few estates in this country the value of the plantations as game coverts, is well nigh of as much importance as that of the timber produced, it will be readily seen that the successful formation and management of these is a matter of no small moment to those intrusted with the work. As to whether game-rearing and forestry can be advantageously carried on in the same woods is, however, a question we by no means feel inclined to uphold, and from which, being apart from the subject-matter of our paper, we will for the present stand aloof.

Game coverts may be divided into two kinds, natural and artificial—natural, when the woods are kept sufficiently thin to admit of the free growth of bramble, bracken, or other rough vegetation; and artificial when the planting of such shrubs as are suitable for underwood is resorted to.

Natural game coverts, which, by most sportsmen, are considered superior to those artificially formed, can only exist where the plantations are kept well and regularly thinned, so as to admit abundance of both light and air—the two principal requisites for the successful growth of natural underwood. Generally speaking, the formation of natural coverts has seldom to be helped, although occasionally in such coverts we have found it necessary to assist nature by the sowing of such seeds as those of gorse, broom, etc., in the thinner and more open portions of the woodlands. This may, however, be considered as an exception to the rule, as where the woods are kept sufficiently thin, spontaneous undergrowth is usually pretty abundant, and requires neither care nor management, beyond preventing its too free incursions along the margins of roads and shooting drives. Where, however, bare patches do occur, the sowing of seed may be relied upon as not only a speedy but most effectual method of increasing the cover. Where seeds are intended to be sown, the soil should be thoroughly prepared by a slight picking, after which it may be dug over, and all hard clods or lumps broken down, and the whole made smooth and fine with a rake. The seeds may be sown in spring, and afterwards covered over with hardwood branches as a preservative against the depredations of small birds and game.

The best natural game coverts are those composed of bramble, gorse, heath, hazel, blackthorn, elder, blaeberry, bracken, or the stronger growing grasses, these being arranged according to merit, and each possessing some peculiar feature, specially recommending it for planting in certain soils, altitudes, or situations.

In the formation of artificial game-coverts, when not only shelter and protection for game are required, but ornamental effect as well, the judicious grouping of the different shrubs should never be lost sight of, more especially when the coverts are within the park or policy grounds, and visible from drives and roads. Formality and stiffness are so often the characteristics of the present style of shrub planting, that in many cases our woodlands seem utterly destitute of that variety of outline and contrast of light and shade so essential to picturesque beauty. In planting evergreen shrubs for the two-fold purpose of covert and ornament, the best method is to plant each variety in separate groups or clumps. No hard and fast lines can be laid down as to the distribution or number of plants to be used in the clumps, which, to a great extent, must depend on the size and shape of the ground as well as taste of the operator. They should, however, be placed at irregular distances apart, be irregular in size and outline, and with from a dozen to forty or fifty plants in each—bearing in mind that game of all kinds delight in small patches of shrubs with abundance of open space around each, but detest, in a most marked manner, continuous masses or jungles of underwood.

In selecting sites for the various groups, be careful to choose the most open positions, avoiding as much as possible planting immediately under the spread of trees; and, if practicable, so arranged that in viewing the wood from any point the eye may not pass along a straight bare unplanted space, but become arrested by the various clumps in passing to the farther side.

Having arranged the positions of the various clumps, the pits should be opened of a size, and at a distance apart suitable for the plants intended to be used, taking care that they are sufficiently large to avoid cramping or bending of the roots, which in all cases should be spread out to their full extent. In making the pits, it is well to thoroughly loosen the soil in the bottom and sides with a pick, so as to give the tender rootlets a free course when starting into growth in spring. Should the soil be found of inferior quality, a few loads of leaf mould, road-scrapings, or loam from an adjoining field will be found to work wonders in the way of giving the plants a start,

and also by producing a strong healthy growth. Drainage should also have been attended to previous to opening the pits, and all stagnant water or superfluous moisture removed by the formation of open drains.

In giving a list of the best evergreen shrubs for covert purposes, I would call attention particularly to the merits of laurel, box, privet, laurustinus, holly, and yew, as these have been very extensively used on this estate for underwood, and with the best possible results. As to which of the above shrubs should receive pre-eminence as an ornamental covert plant I cannot decide, each having some peculiar merit rendering it valuable in its own particular place. We will, for the present, however, consider all alike in this respect, and briefly describe the value of each separately, beginning with the laurel.

The common and Colchic laurels are amongst our best shrubs for underwood, and should be planted extensively; they are of free growth, bear cutting and pruning well, and thrive under the shade and drip of other trees. For covert planting the Colchic is perhaps preferable to the normal form, as it is of a more dense and procumbent habit, perfectly hardy, and less liable to injury from hares and rabbits. The common laurel requires frequent and heavy pruning to keep it in bounds, as, if allowed to ramble at will, it soon becomes bare near the ground, and useless either as game covert or ornament. Last spring we layered a great number of this plant that had through neglect become useless for the purpose intended, many being from 12 feet to over 20 feet in height, and with simply a tuft of foliage near the top. In layering, we sawed the stems half through near the ground, to assist in bending, and laid the plants flat on their sides, a couple of stout pegs being driven alongside, the crooked heads of which served to keep the plants in their procumbent position. A spadeful of soil was then placed on the top of each peg to assist the layer in rooting. The result at the present time is everything that could be desired, each stem having thrown up quantities of young shoots, and thus formed a jungle of underwood, which year by year will increase in value.

In planting the laurel for covert avoid overcrowding, as, being of quick growth, the plants, even although placed at a considerable distance apart, soon unite and form a continuous undergrowth. No rule can be laid down as to the distance which should be allowed between individual plants, this depending entirely on their size as well as quality of the soil in which they are to be planted. Here we not unfrequently plant double thick, either for immediate

effect, or to produce covert at once, and when the plants begin to encroach on each other every alternate one is removed, thus giving the remaining plants ample room for developing side branches and thereby inducing a dwarf-spreading habit. Having a tendency, especially when confined, to increase more in height than width, the laurel, after a few year's growth, should have all the leading and straggling upper branches cut over, which will not only increase the under shoots but prevent the plants running up into tall, branchless poles.

The green tree-box (*Buxus sempervirens*) forms a very pretty as well as desirable covert plant, and thrives well beneath the densest shade of deciduous trees. It is also of slow dense growth, and well adapted for planting in various soils and situations, although preferring a light loam and shady position. Another recommendation is its immunity from the attacks of game, hares and rabbits having such an aversion to this plant, that even during the most severe weather, I cannot remember having seen it injured. Few plants suffer more from overcrowding than the box, and for this reason it should be planted at wide distances apart, the plants soon getting top-heavy and falling over of their own accord. Where the plants are not of large size, and immediate effect or covert is required, they may be planted pretty close, and in a few years, when encroaching on each other, every alternate one may be removed. It is well adapted for transplanting, the almost solid mass of matted roots holding the ball of earth firmly together, thus rendering the plant one of our easiest as well as safest to remove.

The box would seem at one time to have been more abundant in our own land than it now is; thus, Boxley in Kent, Boxwell in Gloucestershire, and Boxhill in Surrey, were named from the quantity of this plant which was formerly found in their neighbourhoods.

Privet, as a covert plant, has its advantages and disadvantages. On the one hand it is cheap, easily grown, and not at all fastidious about soil. When planted amongst trees it, however, generally assumes a loose, straggling habit, and as the shade increases it usually dies out altogether. Where the plantations are well-thinned and kept regularly so, privet, if a little care and trouble be expended on its cultivation, will succeed and form capital underwood. In planting privet the greatest care is necessary to prevent its being overdone. Close planting is always productive of the most unsatisfactory results, not only as regards the health of the plants, but management of the woods as well. Instead of filling up the

whole ground, as is not unfrequently done, plant in small clumps, and these at wide distances apart, which will not only allow the privet to grow more healthy and compact, but also admit of space for pruning and layering—two necessaries for the successful cultivation of privet as underwood.

The layering of privet, which is a simple though effectual and inexpensive method of increase, is performed as follows:—cut off all the branches, except those intended for layering, these being laid flat on the ground equidistant around the main stem or root and kept fast by hooked pegs driven firmly down. A spadeful or two of soil should then be placed on the top of each peg, which will partly exclude air and hasten the formation of roots. The pegs may be made of any refuse branches—hard wood, such as ash or oak, being preferable—about 10 inches in length, one end being hooked for holding the branch in position, and the other sharply pointed for ease in driving. As several forms of privet have crept into circulation of late, it is well to be sure that none unless the true evergreen be used in the formation of game coverts. The oval-leaved privet, though a most desirable evergreen plant and well-suited for ornamental hedges, is from the too luxuriant growth and upright form hardly to be commended for underwood, at least its merits in this respect are inferior to those of the common form.

Aucuba Japonica and the laurustinus are two of our handsomest evergreen shrubs, but, unlike those already described, they will not succeed in the densest shade. In open places or alongside woodland drives they thrive well, and are excellent for variety and contrast. The laurustinus cannot, however, be considered as perfectly hardy in this country, for even in our maritime situation here, where the air is to some extent ameliorated, it suffers severely from frost, and is even, during severe winters, killed completely to the ground. It, however, springs very freely from the root, and in a few years quite regains its original size and luxuriance. A beautiful hedge of laurustinus in our home nursery was killed during the severe winter of 1881-82. It was cut over in the following spring, and is now a dense compact fence of nearly four feet in height. From their bushy, well furnished habit of growth both the above plants are excellent as game covert, more especially around the outskirts of woods and plantations. They should be allowed plenty of room for development of both root and branch, though they may, when necessary, be pruned with the greatest advantage.

Mahonia aquifolia and *Berberis Darwinii* are frequently recommended as covert plants and for using in similar situations with the laurel and box. Along the margins of plantations or in very open places they may and do succeed, but from practical experience of these plants we find them next to useless as underwood in shady positions. Here, where many thousands of covert plants are used annually, we have entirely discarded them from use unless in the most open situations. These plants are highly ornamental, both in foliage and flower, produce berries which are much sought after by game, are quite hardy, and not at all fastidious about soil—qualities which specially recommend them for extensive use in positions at all suited for their growth.

The barberry, more especially when planted out in rich soil, and when at all confined, is apt to lose the compact, branchy nature so recognisable a feature of the plant when allowed ample room in the nursery border, and to assume a more upright habit of growth, which is anything but desirable in underwood generally. To check this and keep the plant in bounds, frequent slight prunings will have to be resorted to, and this had best be effected during dull, damp weather, as the barberry is not a good subject for the pruning shears. Neither the barberry nor mahonia are adapted for planting in very high or exposed situations—at least, where such has been tried on this estate, the results have been anything but satisfactory, the plants soon presenting a miserable, half-starved appearance.

Both plants are readily propagated—the mahonia, when planted in loose soil and an open situation, soon covering a considerable space of ground, the running roots being especially active under such circumstances.

Rhododendron ponticum, although useful in an ornamental point of view, cannot be considered as a first-class plant for game shelter. It has, however, several good qualities which recommend it for underwood, such as ease of culture, dwarf-spreading habit, and immunity from the attacks of game—indeed, in this latter respect, it is not equalled by any other plant, if we except one or two species of daphne. It is seldom resorted to by pheasants, the bottom being not only damp, but such a tangled mass of branches, that it is anything but pleasant quarters for game. For ornamental effect along the outskirts of plantations, the rhododendron is invaluable, and is by no means so fastidious about soil as is generally supposed, peat being not at all an essential to its growth and successful cultivation. Few plants can be made to

increase in like proportion with the rhododendron, and for this reason it should be planted in small patches; and when it is desirable to increase the cover, the outer branches may be pegged down or layered. This plant also bears pruning with impunity, so that old plants that have, through neglect, become lank and straggling may without fear or risk be layered or pruned in with advantage.

The common Yew and Holly cannot be too extensively used in the formation of game coverts, both being unrivalled for beauty and hardiness. They thrive in a great variety of soils, and beneath the densest shade of our woodland trees. In planting the yew it is well, however, to bear in mind that it is highly deleterious to stock that may browse upon its branches, and for this reason should never be planted along the outskirts of a wood, or in any position to which they have access.

The St John's Wort, as a low-spreading shrub, is unsurpassed, and thrives best in a light sandy or peaty soil. It is readily propagated by division of the roots; and when planted out in small patches a foot or two apart, the creeping stems soon cover a considerable surface of ground, and form a dense evergreen mass, covered in summer with bright golden flowers.

Gaultheria Shallon, another plant of creeping habit, is, notwithstanding its many good qualities, seldom planted to any extent in our woodlands; but this may, to some extent at least, be accounted for by the high price of the plants, as well as the small size of those purchaseable from our nurserymen. Like most other North American plants, the Gaultheria prefers a rather damp, peaty soil, and is one of the few shrubs found to thrive in pine plantations. The berries, which are borne in great abundance, are greedily devoured by pheasants, and in their native country are not unfrequently used as food.

The Butcher's Broom is a fine glaucous green shrub, densely covered with sharp, prickly leaves, and invaluable for planting in shady places—indeed, in such positions it seems to be quite at home. Here it flowers and fruits freely beneath half-standard rhododendrons where few other plants could exist, far less succeed. The twigs of this shrub were formerly used by butchers for sweeping their blocks; hence the English name.

Some of the above plants, notably the St John's Wort and Gaultheria, may be considered as carpet plants, which, in contradistinction to general underwood, may be classed as evergreens, which, from their low, procumbent mode of growth, are scarcely in the true

sense of the word suited for game coverts. To clearly define the difference would, however, be no easy matter, and, even were it possible to do so, would in the end be productive of but little good, as the habits of different plants vary so much, that what is used in one place for carpeting purposes might in another and more favourable situation be equally valuable for game covert. A good example of this will be found in the St John's Wort, which, when planted out and allowed to ramble at will amongst bramble, privet, etc., forms a capital covert; whereas, when used in open, airy situations—such as alongside shrubbery walks—soon forms a dense evergreen carpet, of so compact a growth as to be almost impenetrable even to ground game.

In addition to the above-named plants, the following are well adapted for giving shelter to game:—Dogwood, Hazel, Elder, Arbutus, Cotoneaster of sorts, Juniper of sorts, *Pernettya mucronata*, *Rubus nutkanus*, *Taxus adpressa*, *Photinia serrulata*, *Kalmia latifolia*, *Garrya elliptica*, etc. These should be planted out in small groups—the more valuable kinds in the most conspicuous position, such as alongside or within view of woodland drives and shooting roads.

Protection from Rabbits, etc.—It may seem somewhat absurd to speak of planting game coverts, and then to protect them from their depredations; but that this is highly necessary for the first two years, at least, is well known to all planters. Few of the shrubs treated of in this paper are exempt from the attacks of hares and rabbits, more especially when in a young state, and newly transferred from the nursery; and for this reason it is always found necessary to protect them in some way or other until fairly started into growth and beyond the reach of game. For this purpose wire netting is the cheapest and most effectual preservative with which I am acquainted. The netting should be about 4 feet in height, not more than 1½-inch mesh, and inserted in the ground 4 inches, to prevent rabbits from working underneath. It may be fixed to posts driven firmly into the ground at a distance of 5 feet apart along the line of fence. This precaution against the depredations of game may not be necessary for all the clumps, but it is especially so for those of laurustinus, barberry, and laurel.

For the first two or three years after planting, the shrubs should be kept free of grass and weeds, which will encourage the plants to start into growth quicker and thrive much better than they can do if the ground is impoverished and light and air excluded by weeds.

FORESTRY IN FRANCE.

By Major F. Bailey, R.E.

CHAPTER I.

THE WOODS AND FORESTS OF FRANCE.

In 1876, the last year for which anything like complete details are available, the total wooded area of France, exclusive of isolated trees, such as those growing in parks and on roadsides, which were not planted for the sake of the timber they produce, amounted to 35,464 square miles, or a little more than 17 per cent. of the entire area of the country. The proportion in other European countries is as follows, viz. :—

Russia,	40	per cent.
Sweden,	34	,,
Norway,	29½	,,
Germany,	26	,,
Turkey,	22	,,
Switzerland,	18	,,
Greece,	14	,,
Spain, Belgium, and Holland, each	7	,,
Portugal,	5	,,
The British Isles,	4	,,
Denmark,	3½	,,

The average of all the European States, taken together, is 29½ per cent. The population of France being 181 per square mile, it follows that the area of woodland per head is about three-fifths of an acre.

Some changes, which will be noted in a subsequent chapter, have taken place in the area of the State forests since 1876, but in

that year the woods and forests were owned in the following proportions by the different classes of proprietors, viz. :—

	Square miles.	
The State, ...	3,734 = 10·7	per cent.
Communes and sections of communes,	7,949 = 22·4	,,
Public institutions, . .	124 = 0·3	,,
Private proprietors, . .	23,657 = 66·6	,,
	35,464 = 100	

and these figures may be taken as fairly representing the actual position at the present time.

Forests are not so exhausting to the soil as agricultural crops. In the case of the latter, the entire plant, except the roots, which are sometimes also taken, is removed, whereas with a crop of trees, the leaves, flowers, and fruit, which are far richer in nutritive elements than the wood, are annually returned to the soil, and thus serve to maintain its productive power, as well as, by their protective action, to keep it in a good physical condition. Hence forests can flourish on comparatively poor soil; some kinds of trees, notably most of the conifers, being able to grow on ground that would be quite incapable of producing a series of remunerative agricultural crops; and it is therefore, generally speaking, out of place to keep rich fertile valleys under forests, which ought rather to be maintained on ground which cannot be profitably cultivated. In well-populated districts, matters naturally tend to settle themselves in this manner; the better classes of ground being brought under the plough, while every acre of the rest of the country is kept wooded, in order to meet the domestic and agricultural wants of a dense population. But it is otherwise in less favoured localities. Here vast areas might be devoted to the production of wood; but while, from the nature of the case, the local consumption is in such places very small, the absence of communications frequently renders export very difficult. Hence wood has but a very small value, and the forests tend to disappear gradually before the excessive grazing to which they are subjected; for the population of such regions, being unable to make its living by agriculture, is, generally speaking, driven to adopt a pastoral life.

Forests grow in France at all altitudes up to about 9000 or 9500 feet above the sea, a much larger proportion of them being found at low than at high levels. Thus it has been calculated that if the country were divided into altitude-zones of 200 metres each (656 feet), the lowest zone would contain 36 per cent. of the forests, while

the highest would not contain more than ·04 per cent. of them; the fifth zone (2600 to 3300 ft.) would, however, on account of the extensive plateaux existing at this level, contain more than the fourth. Forests situated at high altitudes do not produce so much wood, and are therefore not so profitable, as those grown lower down; consequently the private owners, who have done their best to preserve their woods in the plains and low hills, have, in the majority of cases, allowed the mountain forests they once possessed to be destroyed by over-grazing. Hence it arises that while at altitudes below 4000 feet, the proportion of State and communal forests is comparatively small, hardly any private woods are found above the level of 6000 feet, such forests as exist there being, generally speaking, maintained by the State or the communes in the public interest, as a protection against avalanches and the formation of torrents. The private forests are then, taken as a whole, more favourably situated than those which belong to the State and the communes, both as regards soil, climate, means of export, and proximity to the markets. It has been calculated that the distribution of the forest area by zones of altitude is thus proportioned:

	Forests under the Forest Department.		Private and Communal Forests not under the Forest Department.	Total.
	State.	Communal		
M. M. Ft. Ft.				
Plains, 0 to 200 = 0 to 656	41 %	5 %	45 %	36 %
Low hills, 200 to 500 = 656 to 1640	32 ,,	48 ,,	25 ,,	31 ,,
Mountains above 500 = above 1640	27 ,,	47 ,,	30 ,,	33 ,,
	100	100	100	100

It is said that if the trees could be grouped together, so as to form a series of pure forests, the proportion of the total area which would be occupied by each species would be as follows:—

Oak (*Q. sessiliflora* and *Q. pedunculata*),	29	per cent.
Beech,	19	,,
Hornbeam,	12	,,
Silver fir,	7	,,
Scotch pine,	4½	,,
Evergreen oak (*Q. Ilex*),	4	,,
Maritime pine,	3	,,
Spruce,	3	,,
Larch,	2	,,
Other kinds,	16½	,,
	100	

The small number of species which enter to any important extent into the composition of the French forests is very remarkable. Thus it appears that oak, beech, and hornbeam occupy 60 per cent. of the tree-covered area, more than one-half of the remainder being taken up with six other species; but many other kinds are disseminated throughout the forests in various proportions according to circumstances. As a matter of course, however, the trees are not grouped together in the above manner, and, neglecting blanks, the crop on the ground is actually constituted somewhat as follows:—

Pure forests,	Broad-leaved (oak or beech), ...	15	per cent.
	Coniferous (silver fir, pine, spruce, or larch), .	13	,,
		—28	,,
Mixed forests,	Broad-leaved (oak, beech, and hornbeam), .	52	,,
	Broad-leaved and coniferous (beech and silver fir, or oak and pine), ...	18	,,
	Coniferous (silver fir and spruce), . . .	2	,,
		—72	,,
		100	

Or, separating the broad-leaved and the coniferous forests from those which consist of a mixture of the two, we have

Broad-leaved forests, pure and mixed, . .	67	per cent.
Coniferous forests, do., . .	15	,,
Broad-leaved and coniferous forests, . .	18	,,

The State forests show a smaller proportion of pure crops than are found in those of the communes, but they also comprise a very much larger proportion of forests in which the crop consists of a mixture of broad-leaved and coniferous species. The first of these differences is due to the circumstance that a mixture, which is always desirable from cultural considerations, has been systematically maintained in the State forests from a remote period, whereas this has not always been the case in the communes. The second difference is chiefly accounted for by the fact that those parts of the State broad-leaved forests, where, from various causes, the soil has become much deteriorated, have frequently been planted up with conifers, which are the only kinds likely, on account of their capacity to grow on poor soil, to succeed under such conditions; but these are, in such cases, only intended to act as nurses to broad-leaved species, which are subsequently to be raised under their shelter. But little work of this kind has yet been accomplished in the communal forests from want of the needful funds.

The private forests resemble those of the communes rather than those which are State property, but a further comparison in this respect between them and the other classes of forest need not be made at present.

Many circumstances combine together to influence the nature of the vegetable growth, which characterises any particular locality. Thus, a "limestone soil," which is one containing more than four or five per cent. of carbonate of lime, is usually marked by a rich and varied vegetation; while on a silicious soil the flora is much more simple and uniform, the undergrowth being often formed of Bilberry (*Vaccinium myrtillus*), broom, and heather. Forty-four per cent. of the French forests are on limestone. But the principal forest trees are not much affected by the chemical composition of the soil—the two deciduous oaks, the beech, hornbeam, silver fir, spruce fir, and larch, being classed as "indifferent" to it. The evergreen oak, however, shows a preference for limestone; and the Scotch pine flourishes best on a silicious soil; but the maritime pine will not grow on limestone. The climate, which varies with the latitude, altitude, amount and distribution of the rainfall, proximity, or otherwise of the sea, and other conditions, is the principal factor in determining the distribution of trees, each of which finds its home in the locality which best suits its temperament. The hot region of the south, the temperate regions of the north and centre, and the mountains, are each characterised by the spontaneous vegetation to which they are adapted. Thus, in the south, are found the evergreen oak and the maritime pine; while the spruce, the silver fir, and the larch inhabit the mountains; and the five other species mentioned, grow chiefly in the temperate region. The physical condition of the soil also exercises an important influence on the growth and local distribution of trees; for example, *Quercus pedunculata*, and the hornbeam, will grow on moist soil, which does not suit either *Quercus sessiliflora*, the beech, or the evergreen oak.

During the entire course of their development, trees of all kinds require light; but during the early stages of their existence, some of them must be completely in the open, without any cover at all; while for others, various degrees of shade are necessary. This quality of the young plants is, generally speaking, in direct relation to the abundance of the foliage of the adult tree from which they spring. Those which, when young, require much light, such as the larch, the pines, and the oaks, are called "robust," or trees of light cover, while others, which will not stand exposure, such as the

beech and silver fir, are called "delicate," or trees of heavy cover. The spruce and the hornbeam are classed intermediately between kinds of light and heavy cover. This is a very important question for the forester, not only with reference to the method to be adopted for raising of a crop of any particular kind of trees, but also with regard to their coppicing power, their effect on the soil, and other matters. Trees of light cover, generally speaking, coppice better than those of heavy cover, but the latter have a much greater effect than the former in improving the soil.

It is estimated that the 35,464 square miles of woods and forests yielded the following produce in 1876, viz., 17,896,227 loads (50 cubic feet) of wood of all qualities, 321,741 tons-weight of tanning bark, 2556 tons-weight of cork, and 31,539 tons-weight of resin; the whole being valued at £9,471,017. The average production of wood was therefore 39 cubic feet per acre; and the gross revenue, omitting that on minor produce, which was very small, was equal to 8s. 4d. per acre. But, in addition to this, it is calculated that the isolated trees, not grown for the sake of their timber, and vines yield together $3\frac{1}{2}$ million loads per annum, valued at £1,000,000; so that the total production of wood in France is raised to about $21\frac{1}{2}$ million loads, and the value of the wood, bark, and resin to about £10,500,000. This gives the amount of wood and the money value of the forest produce per head of the population as $29\frac{1}{2}$ cubic feet, and 5s. 9d. respectively.

Of the $21\frac{1}{2}$ million loads of wood produced, about 4 million loads were timber, and the rest were firewood. The latter sufficed for the national requirements, but the former was far from doing so; for the imports of wood of this class exceeded the exports by 2,062,432 loads, valued at £6,408,000—that is to say, that it was less than two-thirds of the amount required. The question of foreign timber supply is, therefore, a very important one, even for France, which has 17 per cent. of its area under forest.

CHAPTER II.

FORESTS MANAGED BY THE STATE FOREST DEPARTMENT.

The forest law of 1827, which is still in force, confirmed the previous legislation, under which all woods and forests which

form part of the domain of the State, all those which, being the property of Communes or Sections, or of Public Institutions, are susceptible of being worked under a regular system, and finally all those in which the State, the Communes, or Public Institutions possess a proprietary right jointly with private persons, are administered directly by the State Forest Department in accordance with the provisions of the forest law.

The areas thus administered at the commencement of 1885 were as follows, viz.:—

	Hectares.	Sq. Miles.
State Forests, ...	1,012,688	= 3,910
Communes, Sections, and Public Institutions,	1,967,846	= 7,598
Total, . .	2,980,534	= 11,508

These figures, which include the dunes, represent about 5½ per cent. of the entire area of France, and nearly one-third of the total wooded area. An additional 144 square miles of barren land had, up to the end of 1884, been purchased by the State in connection with the project for the consolidation of bare and unstable slopes on the great mountain ranges; and this area is also administered by the Department under the forest law. About 40 per cent. of the State forests are situated in the plains, while the rest of them, together with nearly the whole of the communal forests, are found in about equal proportions on low hills, up to an altitude of 1700 feet, and on the higher mountain ranges. About one-half of them stand on limestone rock, 92 per cent. of their entire area being actually under wood.

The principal object of the following pages is to sketch in a brief and summary manner the system of management adopted for these forests, so that some general idea may be formed of what the business of the French Forest Department consists in, and what the results of their labours have been, up to the latest date to which information is available under each head. The organisation of the professional staff of the department, and the manner in which it is recruited, will then be explained.

State Forests.

The forests now belonging to the State owe their origin to one or other of the following sources. They either formed part of the ancient royal domain, as it was constituted at the time of the ordinance of 1669, or of the sovereign domains united to France

since that year; or else they were ecclesiastical property confiscated at the time of the Revolution in 1790, or they have been more recently acquired by purchase, legacy, or gift. About one-half of them are ancient royal domains.

The State forests were formerly of much greater extent than they are at present. In 1791 they covered an area of 18,166 square miles, which was reduced to 3792 square miles in 1876, the reduction being almost solely due to sales effected for the benefit of the exchequer; but the loss of territory after the war of 1870 was the cause of a diminution of 374 square miles. The records show that, between 1814 and 1870, 1362 square miles of State forests were sold for nearly 12¼ million pounds sterling, or about £14 per acre; but since 1870 no such sales have taken place, and since 1876 the area has been somewhat increased by purchases and otherwise. It now includes 33 square miles of forest owned jointly with private persons, and 450 acres are temporarily held by the families of some of Napoleon I.'s generals, whose right will in the course of time either lapse or be commuted. The remainder of the area is owned absolutely by the State, but the enjoyment of the produce does not belong exclusively to the treasury, for, as will be explained hereafter, certain groups of rightholders participate in it.

In the next section, the principal points of the laws relating to the communal forests, and of their management by the State Forest Department, will be brought to notice; while in the subsequent sections of this chapter the work of the department in connection with the State and the communal forests will be briefly treated of, in such a manner as to bring out and compare the results obtained in the two classes of forests.

Forests Belonging to Communes, Sections, and Public Institutions.

The territory of France is divided into 39,989 communes or village communities, of which about one-third are forest proprietors. Certain groups or sections of the inhabitants have, however, rights, and own property, apart from the commune in which they reside, and these are also owners of considerable areas of woodland. Those forests belonging to communes or sections, which are susceptible of being worked on a regular system, are managed directly by the State Forest Department, for the benefit of their owners, the principal features of this management being as follows, viz.,—the laws

relating to State forests are, generally speaking, but with certain exceptions, applicable to them; they cannot be alienated or cleared without the express and special sanction of Government in each case; they cannot be divided up among the members of the community; the annual sales of produce are effected by the State forest officers, and the money realised is paid directly by the purchasers into the communal treasury; before the sales take place, the quantity of timber and firewood required by the inhabitants for their own use, is made over to them, usually standing in the forest, and it is subsequently worked out by a responsible contractor; three-quarters only of the total annual yield is available for distribution or sale, the remaining quarter being left to accumulate, and thus to form a reserve fund or stock of timber from which exceptional necessities either in the way of wood or money can be met; the distribution of firewood is made according to the number of heads of families having a real and fixed domicile in the commune; the entry of goats into the forest is absolutely prohibited, while the grazing of sheep is only permitted temporarily, and under exceptional circumstances, with the special sanction of Government in each case; no grazing of any kind can be carried on in the forests, except in places declared out of danger by the forest officers, who have the power to limit the extent to which it can be practised with reference to the quantity of grass available; the forest guards are chosen by the communal authorities, subject to the approval of the forest officer, who delivers to them their warrants; the State defrays all expenses of *management*, including the officers' salaries, the marking of trees, notifying of sales, office charges, and the prosecution of offences; the State is reimbursed by the payment from the communal treasury of a sum equal to 5 per cent. on the sales of principal produce, including the value of the wood made over to the inhabitants; but this payment, which forms a first charge on the forest revenue, can never exceed the rate of one franc per hectare (about 4d. an acre) of the total area thus managed; the communes pay the guards' salaries, the taxes, and all charges for the maintenance and improvement of the forest, including planting, sowing, and road-making, as well as those for extraordinary works, such as demarcation, survey, and the preparation of working plans. In all this the forest officers are bound, by law, to act on the principle that they are managing the property *for the benefit of its owners*, who must be consulted through their representatives, the Mayor and the municipal council, in all matters affecting their interests,

and whose wishes must be acceded to when they are not opposed by the legislation, or contrary to the recognised principles of scientific forest management.

The principal public institutions are hospitals, charitable associations, churches, cathedral chapters, colleges, and schools; and the forests belonging to them are subject to administration by the State Forest Department on precisely the same terms as are those of the commune and sections.

Of the area of 7598 square miles shown as being thus managed on behalf of these bodies at the commencement of 1885, about 100 square miles belong to public institutions, and about 7500 square miles to communes, including sections. Of the remainder of their forests, about 410 square miles owned by the latter, and about 27 square miles by the former, are managed respectively by the communes themselves under the municipal laws, and by the administrative councils of the institutions.

Changes in this respect frequently take place; for every year a certain number of applications to free forests from the restrictions which State control involves are granted, while in other cases the owners demand or consent to their imposition. The records show that sanction has, since the year 1855, been accorded to the clearing of 35 square miles, and to the alienation of 40 square miles of the forests belonging to these bodies; but it is probable that the permission has not, in all cases, been acted on.

For the sake of convenience, the forests belonging to communes, sections, and public institutions, will in future be spoken of collectively as "communal" forests.

Demarcation and Survey.

Up to the end of 1876, the work of demarcation had made good progress in the State forests, only 13 per cent. of which then remained to be completed, while 30 per cent. of the communal forests had still to be dealt with. The demarcation is indicated by dressed-stone pillars, with intermediate ditches or dry-stone walls, according to the custom and resources of each locality. The ground is usually re-surveyed after the demarcation has been completed, and at the end of 1876 about three-fourths of the State forests and one-half of the communal forests had been thus re-surveyed and mapped, the prevailing scale being $\frac{1}{5000}$ ($12\frac{2}{3}'' = 1$ mile) and $\frac{1}{10000}$ ($6\frac{1}{3}'' = 1$ mile). Pending the completion of this work, the old maps are used

for such of the forests as have not yet been re-surveyed. In the communal forests the work of demarcation and survey is less advanced than it is in the State forests, because the charges for such work have to be defrayed from the communal treasury, and the needful funds are not always forthcoming.

Systems of Culture.

The climate of France is singularly favourable to the natural regeneration of forests, which is, generally speaking, relied on—planting and sowing being only resorted to in the comparatively rare instances in which success cannot otherwise be achieved, such cases including, of course, the stocking of extensive blanks.

There are two main systems of culture—one known as "high-forest," and the other as "coppice."

A High-forest, which is usually destined to produce timber of large size, is one composed of trees that have been raised from seed, its regeneration being effected by means of seed, generally speaking self-sown. There are two methods of treating the forest in order to produce this result. In one of these the trees of each age-class are grouped together, and are subjected to periodical thinnings, until the time arrives for regeneration, which is effected by a series of fellings, the first being a more or less light thinning, intended to promote the formation of seed and the springing up of the young seedling plants. The seed-felling, as this is called, is followed at intervals by a series of secondary fellings, usually three or four in number, which are made in order to meet the gradually increasing requirements of the young growth in the way of light; and ultimately the remainder of the old stock is removed by a "final felling." In this manner the marketable stems are gradually cut down and disposed of, the young crop being left to go through the same stages as its predecessor, and so on throughout successive generations of trees. In the selection method (known as *jardinage*), on the contrary, the trees of all ages are mixed over the whole area of the forest; there are no regular thinnings of the kind made under the first method; and the annual cuttings are effected by taking marketable trees here and there within a certain area of the forest, the blocks composing which are successively treated in the same manner, so that the entire forest is worked over within a fixed period of time. When treated by the first method, the forest is grown under very artificial conditions; for the age-classes are never in nature found thus grouped

together; but by the selection method, on the contrary, a more or less near approach to a natural forest is obtained.

In the COPPICE system the regeneration is principally effected by means of coppice shoots. There are two methods of treatment—*simple coppice*, in which there are no reserved trees, and the crop is clean-felled over successive portions of the forest; and *coppice under standards*, in which standard trees are selected and reserved, with a view to their remaining throughout several generations of coppice shoots—generally at least three, but often four or five. Many forests are now undergoing conversion from the system of coppice to that of high-forest.

The following statement shows the extent to which the two systems were applied, in the State and communal forests, in 1876, since which year no important changes have taken place. The areas are given in square miles.

	High-forest.	Under Conversion.	Coppice.	Pastures.	Total.
State Forests, . .	1648	1121	740	225	3,734
Communal Forests, .	2229	54	4808	92	7,183
Totals, . . .	3877	1175	5548	317	10,917

It will be seen that there is a marked difference between the State and the communal forests in this respect. In the former, nearly three-quarters of the total area are either now under high-forest or under conversion to that system; while in the latter, two-thirds of the total area are under coppice, and less than one-third is either under high-forest or under conversion.

High-forest being usually destined to produce large timber, the trees must be left standing until they have attained a considerable age; and the capital, both in timber and money, which is locked up in it, is therefore much larger than that in a forest under coppice. Other conditions being equal, the quantity of wood produced annually is, however, much the same under both systems; but owing to the greater value of the produce obtained from the high-forest, its money revenue is greater than that of the coppice, while on the other hand it is found that coppice yields a higher rate of interest on its smaller capital value than high-forest, and on this account it is a more suitable system for adoption by communes. Coppice possesses, also, a further advantage for them, in that it yields for the use of the inhabitants timber and other produce more varied in kind and dimensions than are obtainable from high-forest, and it

thus satisfies their requirements, which are chiefly in fuel and small-sized timber, much better than forest managed under the latter system. But even in cases where the conversion of communal coppice to high-forest is deemed advisable, it is always found difficult to reduce the annual fellings to the quantity necessary in order to allow the growing stock to accumulate to the required extent; while the small size of the greater part of these forests renders them unsuited to the treatment which they would have to undergo in order to effect their conversion. The coppice system, including coppice under standards, is therefore in vogue in almost all communal broad-leaved forests, such high-forest as the communes possess being found chiefly in mountainous regions, and being composed of coniferous trees, which will not coppice. The area of communal forest shown as under conversion consists principally of tracts in which the coniferous trees are spontaneously taking possession of the ground, and driving out the broad-leaved species. It follows from what has been said above that the State alone can, generally speaking, raise broad-leaved high-forest on a large scale, or undertake the conversion of coppice to high-forest.

A further difference between the systems of culture generally adopted for the State and the communal forests may be noted, viz., that whereas in the former less than one-fifth of the high-forest is treated by the selection method, three-fourths of the communal forests are so treated. In mountainous regions, where, as has just been said, the greater part of the communal high-forest is found, the selection method possesses incontestable advantages, in consequence of the continuous cover which it affords to the soil; but although the respective merits of the two methods, as applied to coniferous forests situated in such regions, are much disputed at present, there has of late years been an undoubted tendency to return to selection, which has for some time past fallen into discredit, and, taking the State and communal forests together, somewhat more than one-half of the total area of their high-forest is now treated in this manner.

Two variations of simple coppice are sometimes practised: (*First*) That known in the Ardennes as *sartage*, in which, after the wood has been cut and removed, the twigs and chips are burnt on the ground, in order that their ashes may give to the soil sufficient manure to permit of the growth of a crop of cereals during the year immediately following the cutting. This system, which, as carried out in France, seems to be practised rather for the sake of obtaining the crop of corn than as a method of forest culture, is gradually

dying out. It is not adopted in the areas under the State Forest Department. (*Second*) That known as *furetage*, in which, instead of clean-cutting the coppice, those shoots only are taken which have attained to certain fixed dimensions, the operation being repeated annually, or after intervals varying from two to five years. *Furetage* prevails chiefly in the valley of the Seine, in the forests from which the fuel supply of Paris is drawn; but it is also employed in the mountainous districts of the south, in the case of forests maintained for the protection of steep slopes, which it is undesirable to denude entirely.

It is impossible here to enter into anything like full details regarding these sylvicultural questions. To study them completely, as they are taught and practised in France, reference must be made to the books on the subject, among which may be mentioned "The Manual of Sylviculture," by G. Bagneris (translated into English by Messrs Fernandez and Smythies), Rider & Son, London; and "*Le traitement des bois en France*," by C. Broillard, Berger-Levrault, Paris.

Working Plans.

Working plans or schemes will, in course of time, be prepared for all forests administered by the Forest Department. The law provides that all these forests shall be subjected to the provisions of such plans, and that no fellings which are not provided for therein, and no extraordinary cuttings, either from the communal "reserve," or in the blocks destined to grow from coppice to high-forest, shall be made without the express sanction, in each case, of the Government, by whom all plans must be approved before they can be adopted.

Subject to due provision being made for the exercise of rights of user, the working plan provides for the management of the forest in the way that will best serve the interests of the proprietor. Unlike an agricultural crop, which ripens and is gathered annually, trees take many years to grow to a marketable size, the actual period that they require being dependent not only on their species, and the natural conditions under which they are grown—as climate, soil, and so forth—but also on the use to which they are to be put. Thus, a coppice being required to yield wood of small size only, may be cut every twenty-five to forty years; whereas a high-forest, which is destined to produce large timber, must stand for a much longer time. It would be excessively inconvenient if the entire crop of such a

forest were felled only once in every 100 or 150 years; and it is chiefly to avoid this that a working plan is required, which prescribes the arrangement necessary in order to allow of the produce being taken out annually, without intermission and in equal quantities, so that a regular and sustained income may be drawn from the forest. For example, a simple coppice thirty acres in extent, of which the crop is to be felled at the age of thirty years, might either be entirely cut down at one time, and then allowed to grow up again for thirty years; or, which would be found much more convenient, it might be divided into thirty one-acre compartments, each of which is to be felled in succession, so that by taking one plot each year, the whole area would be worked over in thirty years. The working plan must then, in the first place, prescribe the age at which the trees are to be felled, with reference to the average number of years that they take to arrive at maturity, or to attain the required size; and it must then fix the yield, or the amount of wood to be annually removed, this quantity being expressed either in the form of an area to be cut over, or a number of cubic feet of wood to be taken out. But in the case of a high-forest managed under the selection method, it is sufficient to fix the number of trees of a minimum size to be cut out annually.

The provisions of a working plan vary according to the nature of the forest to which it relates. In the case of the simple coppice instanced above, the first thing to do would be to obtain a map (see Pl. VII.) showing the principal features of the ground, such as the edge of the plateau, the stream, and the road. The area would then be broken up, for purposes of examination and description, into temporary plots, such as those lettered from (A) to (H), each plot comprising a portion of forest more or less homogeneous in its composition. This study of the crop would enable the area to be divided into the thirty permanent compartments above alluded to, and it would also determine the order in which they should be numbered, so that the older portions might be cut first. It is evident that if one of these be cut every year, the series of compartments will, after the lapse of thirty years, contain forest of all ages from one to thirty years; and if the annual felling be invariably made in the oldest compartment, it is evident that the age of the crop cut will always be thirty years.

To make a working plan for a regular high-forest, to be treated by successive thinnings, is not quite such a simple matter. If the forest is of great extent, it is, first of all, divided into two or more *series* or

sections, each of which is dealt with separately. After the examination and description of the temporary plots, the section (see Pl. VIII.) is divided into a number of equal compartments called *affectations*, and when the ground has once been completely worked over, the crop on each of these will always be within certain limits, in the same stage of development, and subjected to the same kind of treatment. Thus, if the trees are to be felled at the age of 120 years, and there are six compartments, the sixth may contain the young growth, aged from 1 to 20 years, the fifth young poles from 21 to 40 years old, and so on, the first containing the old trees which are to be felled. The compartments having been formed, each of them is then subdivided into compartments usually corresponding in number with the years over which the fellings within it are spread (twenty in this case), and, while the trees are being cut in the first compartment, clearings and thinnings of various recognised degrees are going on in the compartments of the others, until each in its turn arrives at the age at which the trees are to be removed; and it is clear that in this case also the forest will ultimately contain a due proportion of trees of all ages from 1 to 120 years, which is an essential condition. The working plan prescribes the order in which all this is to be done, and it lays down the number of cubic feet of timber of the oldest class which are to be taken out annually from the first or oldest compartment, so that the entire stock on it may be removed within the first period of twenty years, wind-falls and dead or dying trees being always taken first; each of the remaining compartments is similarly dealt with when its turn to be felled arrives. The quantity of wood to be removed by thinnings cannot be prescribed by the working-plan, as they must be made to the extent which is judged necessary in order to develop the trees which are left. The forester's art is to do this skilfully, and ultimately to remove the old trees in such a manner that they may leave behind them a young self-sown crop to take their place, and so on throughout successive generations.

For a high-forest to be managed under the selection method, the arrangement is different. Here it is, of course, equally necessary that all the age-classes should be represented in due proportion, but instead of the trees or poles of each class being grouped together in separate compartments, all classes are mixed indiscriminately over the entire area of the forest, and there is thus no necessity for the formation of *affectations*, or compartments, of the kind just described. Take for instance the mountain forest sketched in

Pl. IX. After the main features, such as the streams, ridges, and roads, have been laid down on the map, the temporary plots, and the descriptions of them, are made as before. The forest might, in the present case, be divided into three sections, the upper of which being on the crest of the hill, is required to be kept as dense as possible, and will not be dealt with in the working plan, as dead or dying trees alone will be removed from it. Suppose that the annual yield of the central section, which is 150 acres in extent, has been fixed, with reference to the estimated rate of growth and degree of completeness of the stock, at 50 cubic feet per acre, and that trees of marketable girth within it contain on an average 100 cubic feet of timber, it follows that the number of such trees which may be removed annually from the section is $\frac{150 \text{ by } 50}{100} = 75$. Theoretically this number should be taken one here and one there over the whole area; but this would be very inconvenient, so the forest is divided into twelve or any other convenient number of equal or nearly equal blocks, from each of which, in succession, the entire number of trees is to be cut; after taking windfalls, the choice falls on the ripest trees, those which are dead or dying being selected first. The section below the road is in another zone of vegetation; it is 100 acres in extent, and its annual yield is calculated at the rate of 60 cubic feet per acre. Suppose, then, that the trees of marketable girth contain on an average 110 cubic feet of timber, the number of such trees to be cut annually is $\frac{100 \text{ by } 60}{110} = 54$. The section will then be divided into blocks,—in the instance illustrated by the map the number is ten,—from each of which in succession the entire number of trees is taken. In this manner each zone of altitude may be dealt with on its own merits, while, at the same time, the annual fellings, being localised, are easy to supervise, and the wood can be disposed of more readily and more profitably than if the trees had been felled here and there over the entire area. The working plan for a forest under conversion would, of course, differ from any of the above; but this somewhat complicated question will not be dealt with here. It is only by an arrangement similar to one of those above briefly sketched, that a permanent annual yield of a particular class of produce can be assured, and that the forest can be secured against the risk of gradual extinction.

A special branch of the Forest Department is charged with the preparation of working plans, which are not made by the local officers, except in the case of small forests, the plans for which they

can frame without interference with their ordinary duties; but they undertake the revisions, which are made every ten or fifteen years in order to guard against errors, and to allow for changes in the rate of growth, or other causes of disturbance. Pending the preparation of such regular plans, the Forest Department draws up provisional rules, which must accord with local usages, where these are not opposed to the recognised principles of sylviculture. Up to the beginning of 1877 regular working plans had been completed for more than two-thirds of the total area of the State forests, and for somewhat less than one-half of the communal forests. The work progresses more slowly in the latter than in the former, because in their case the funds have to be provided by the communes, and the money is not always available; but as a matter of course the most important forests were taken in hand first, and these have for the most part been completed.

The question of working plans has only been dealt with above in an extremely superficial manner. In order to gain anything like a complete idea of the systems pursued in France, the following works should, among others, be studied, viz.: "*Aménagement des forêts*," by C. Broillard, Berger-Levrault, Paris, 1878, and "*Aménagement des forêts*," by A. Puton. A translation of the latter work has appeared in vols. viii. and ix. of the "Indian Forester."

Products Obtained from the Forests.

The yield in wood of various classes having once been fixed by the working plan, it is the business of the department to realise it as nearly as circumstances will permit. As to tanning bark, all that the felled trees or poles will yield is utilised. Cork bark is taken from the living trees, which will not bear the removal of a too large proportion of their protective covering, and hence care has to be taken not to overwork them. Resin is collected on a large scale in forests of the maritime pine (*Pinus maritima*), which only yield it freely on the hot and damp coasts of the south-west.

The yield of minor produce, such as grass, moss, litter, and other things, being small, and details regarding it not being available, this class of products cannot receive more than a passing mention. Neither can account now be taken of the numerous advantages which the forests undoubtedly render to the population, but which cannot be expressed in the bulk or weight of the products drawn from them.

The latest available statement of yield relates to 1876, in which

year the State and communal forests taken together gave 5,620,663 loads (50 cubic feet) of wood, or an average of about 40 cubic feet per acre; also 50,742 tons of tanning bark, 292 tons of cork bark, and 1967 tons of resin.

The yield of wood per acre of the State forests somewhat exceeded that of the communal forests; but while, in explanation of this, it must be said that the greater extent to which grazing is practised in the latter affects their wood production unfavourably, it must also be admitted that a large proportion of their produce is made over to the inhabitants for their own use, and that this is estimated at a low figure, so as to reduce as far as possible the charges against them on account of management by the Forest Department; and the apparent difference is largely due to the latter cause. Of the total yield in wood, 1,364,846 loads were timber, and 4,255,817 loads were firewood; and, as might be expected from what has been said before regarding the different systems of culture adopted, the State forests gave the larger proportion of timber, one-third of the wood from them being of that class; while in the case of the communal forests the proportion of timber was only one-fifth. A still more striking result would follow a comparison of the nature of the produce obtained from the State and from private forests; and since timber is a more useful and valuable product than firewood, the advantage to the country, from this point of view, of considerable areas of forest land being owned by the State is apparent, and the more so when it is remembered that France does not grow more than two-thirds of the amount of building-timber that she consumes.

The communal high-forest is for the most part situated in the mountains, and is composed of coniferous trees, which explains the fact that the greater part of the timber derived from the communal forests is fir and pine, whereas only about one-third of that coming from the State forests is of those kinds.

Sales and Export.

Principal Produce (*Wood, Bark, and Resin*).—With the exception of the produce made over to right-holders, and of that delivered to the inhabitants of the communes from their forests for their own consumption, as well as of comparatively small quantities of timber cut in the State forests for the War Department and Admiralty, the whole of the annual produce is sold by public auction, and no other mode of sale is permitted. There are three

principal systems of disposal, viz.—(1st), sale of standing trees; (2d), sale at a rate per cubic metre, or other unit of the produce, cut, converted, and taken out by the purchaser; and (3d), sale of produce cut and converted by departmental agency. The first of these systems necessitates a previous marking, either of the trees which are to be removed, or of those which are to be reserved; there is no guarantee given either as to the number of trees, or as to their species, size, age, or condition; but they are bought and sold on the best estimate that either party can make of their value as they stand. The purchaser, as a matter of course, cuts up and exports the wood at his own cost, and in the form which best suits him, being bound under severe penalties to carry out this work in the manner prescribed by the conditions of sale. It has been urged that this system needlessly introduces a middle man between the producer and the consumer, and that thus the profits of the former are reduced, while the regeneration of the forest may be compromised by felling and exporting the trees in a careless or ignorant manner; but in reply to this, it may be said that the wood-merchant must always exist, as it is but rarely that the actual consumer can himself go to the forest to get what he wants; and that, by strictly enforcing the conditions of sale, which are framed with special regard to this object, interference with the regeneration of the forest is practically avoided.

The second method differs from the first, only in that the auction-sale determines merely the *rate* at which each of the various classes of produce is to be paid for; but it is open to the objection that the classification of the produce is difficult, and it thus leads to frequent disputes, in the settlement of which the interests of the proprietor (State or commune) may be allowed to suffer. This method is rarely adopted, except in the case of thinnings, when the quantity of wood cannot well be accurately estimated beforehand.

The sale of timber, cut and fashioned by departmental agency, is rarely resorted to; it has certainly the advantage that the work is better done, and that more complete precautions can be taken to secure the regeneration of the forest; but on the other hand, the State, or the commune, as the case may be, must advance all the money for the work, and the forest officers become charged with a large amount of supervision and accounts, while a number of purchasers are admitted to the forest, and offences of various kinds are from time to time committed by them. But the chief objection to the system is, that the wood is not always cut up in the manner

which best suits the requirements of the market at the moment, a matter with which the forest officer can never be so well acquainted as the professional timber-merchant, and thus, not only do the general interests of the country suffer by failure to supply wood in the form in which it is most required by the consumers, but the prices realised are not always so good as those which the produce might have been made to fetch had it been cut up in some other manner.

Timber sold standing usually commands a higher rate than it does when disposed of in any other manner; and for this and the other reasons that have been given, the first of the three systems is the one generally adopted in both the State and the communal forests. This method of sale is not generally followed in other European countries; but the French system has stood the test of experience; and it is greatly facilitated by the honesty which, as a general rule, prevails in the trade to which it has given rise.

In consequence of the absence or insufficiency of export roads in Corsica, and of the difficulty experienced in getting purchasers who were willing to take the produce for a single year only, a law was passed in 1840, which enacted that the timber to be cut in any part of that island during a series of years, not exceeding twenty, might be sold at one time to a single purchaser, the State, at the expiry of the term, becoming possessed of all works erected by him, without liability to the payment of compensation for them. A few of such contracts exist to the present day; but both the system of roads and the timber trade having largely developed during the last forty-five years, the practice of entering upon such engagements is gradually dying out.

Minor Produce.—Receipts on account of minor produce form an insignificant portion of the gross revenue derived from the French forests, the most important item being that which is due to the sale of hunting and shooting permits. Produce of this class is not sold so much as a source of revenue, as to enable the agricultural population to make use of it, without giving rise to the idea that they are entitled to it by right. It is sold by private contract, the price being fixed by the conservator, or by the Prefect, or the Mayor, in the case of the State and communal forests respectively. The conditions under which such sales are effected in the State forests, are determined by each conservator, with reference to local circumstances; and he retains the power to forbid the sale from the communal forests of any classes of produce, the removal of which would, in his opinion, be detrimental from a cultural point of view.

Payment for minor produce is often accepted, especially by the communes, in the form of days' work done in the forest.

Wood supplied to the Admiralty.—Every year a notice is sent by the Forest Department to the Admiralty, showing the localities in which trees suitable for naval purposes are to be felled; and the latter department then notifies the number and description of those which it desires to have reserved in each forest. The purchaser of the timber sold from these blocks fells, barks, and conveys the trees marked for the above purpose to an appointed place in the forest, where they are inspected and taken over by the Admiralty officials, who cut from them what they want, the rest of the wood being sold by the Forest Department in the ordinary manner. The forest officer and the marine engineer then agree upon the sum to be paid as the price of the wood removed, and as compensation, to cover losses caused by the depreciation in value of that rejected, and the account is subsequently adjusted in the financial department. Up to the year 1837, the Admiralty had the right to select trees everywhere, including the private forests; but the system was not found to answer, and it was abandoned in that year. Even under existing regulations, a very small proportion of the wood used by the Admiralty is obtained directly from the forests, the greater part of it being bought in the open market.

Wood supplied to the War Department.—The requirements of the War Department are met as far as possible from the State forests, the trees being marked and felled by the Forest Department, and removed either directly by the military authorities, or by the Forest Department at their cost. The account is adjusted in the financial department. But the amount of wood so supplied is very small, as, except in cases where the State forests lie near the fortifications or garrison towns, it is found more convenient and cheaper to purchase what is required in the market.

Roads and Buildings.

Without roads, which are required in order to render the forests accessible, and to facilitate the export of produce, this form of the natural riches of a country cannot be utilised; the construction of good export roads being one of the most important means that can be adopted for raising the forest revenue. Thus, in Corsica, where before 1850 the State forests did not produce more than £200 a year, the annual revenue derived from them was raised in 1868 to £8000, the improvement being due almost entirely to the develop-

ment of the communications. At the end of 1867 there were 2440 miles of metalled and 5380 miles of unmetalled roads in the State forests, and since that year their length has been at least doubled.

The great importance of accommodating the forest guards in suitable houses within the forests, is fully recognised; and out of 3200 guards, 1400 are lodged in 1213 houses, the remainder of them being granted allowances to lodge themselves in neighbouring villages. The proportion of roads and buildings in the communal forests is much less than in the State forests, partly because the communes have to pay for their construction, and funds are not always available, but partly also because the average size of these forests being smaller, roads and guards' houses within them are not needed to the same extent.

At the end of 1867 there were 126 saw-mills in the State forests, all worked by water-power.

Timber-slides, sledge-roads, wire-rope tramways, and such-like means of exporting the wood are very little used in France. A great deal of timber is required for their construction and maintenance, and considering the price that wood of all kinds can command, it is found better and cheaper, even in mountainous regions, to make permanent roads suitable for timber-carriages and carts. They are to be found only in a few localities where the conditions are exceptional.

Portable iron tramways have not yet come into general use as a means of exporting timber from the forests, and it is believed that there is only one in use in France at the present time, viz., that at Baccarat at the base of the Vosges; but the advantages which the employment of this means of transport affords will doubtless shortly be better understood than at present, and a development of the system is to be anticipated—at any rate, in the forests of the plains. The floating of large timber is almost unknown; but firewood for the supply of Paris is still floated from the hills of the Morvau down to the railways.

Financial Results of Working.

The profit derivable from a forest is dependent on a number of causes, among which may be mentioned the species of which the crop is composed, the depth and nature of the soil, the climate, the system of culture, the proximity of great centres of consumption of produce, and the existence of good lines of export.

Taking the average of the last three years for which the accounts

have been audited, it is found that the receipts, expenditure, and surplus of the State forests were as follows, viz. :—

Revenue,	£1,297,748	=10s. 6d. per acre.
Expenditure,	571,347	= 4s. 7d. ,,
Surplus,	£726,401	=5s. 11d. ,,

But if the money spent on the afforestation of mountain slopes and dunes, and on the purchase of additional areas, be excluded, the expenditure on the existing forests is reduced to about £480,000, and the surplus is raised to 6s. 8d. per acre. The actual profit is indeed slightly more than this; for the figures include both expenditure *by the State* on the management of the communal forests, and the contributions paid by the communes on this account. The receipts are supposed to cover the payments, but they rarely do so, and some allowance may be made for this fact when calculating the net profit derived from the State forests, which, during the years referred to, probably fell little short of 7s. an acre. Recent information relating to the receipts, expenditure, and surplus resulting from the working of the communal forests is not available.

The latest year for which full details regarding the gross revenue per acre of the State and communal forests are obtainable is 1876, when the figures were as follows, viz. :—

	State. s.	d.	Communal. s.	d.	Mean. s.	d.
Principal produce (wood, bark, resin),	12	6	7	5	10	0
Minor produce,	0	7	0	3	0	5
Total,	13	1	7	8	10	5

The revenue from the State forests was then, in 1876, considerably higher than that above given as the average of the last three years; and this was due to two causes, of which the first is the exceptionally large number of windfalls which occurred in that year, and the second the comparatively high rates which timber then realised. All but a small fraction of the revenue on principal produce was obtained by the sale of wood and tanning bark, cork being produced only in the forests near the Mediterranean and in Corsica, and resin almost exclusively on the shores of the south-west. The figures relating to the State forests show the results of actual sales; but this is not so in the case of communal forests, as a large proportion of the produce from them is made

over to the inhabitants for their own use, and its value is estimated at a low rate, in order to keep down the amount of their contribution for the services of the State Forest Department, which is levied in proportion to the sum of their gross revenue and the value of the wood delivered to them. In addition to this, it should be said that the revenue on minor produce shows *cash* receipts only, no credit being taken for payments made chiefly in the communes by means of days' work done in the forests. These circumstances account to some extent for the smaller revenue obtained from the communal forests; but the true explanation of this result is to be found in the important influence exercised by the system of culture adopted. In 1876 it was observed that the highest rate of gross revenue was obtained from high-forest, and the lowest from simple coppice, while coppice under standards occupied an intermediate place. It was also found that in the case of high-forest, the areas under coniferous trees yielded a much higher revenue than those under broad-leaved species, chiefly on account of the form of their stems, which enables a very large proportion of sawn timber to be obtained from them, but partly also from the greater value of the thinnings taken from them during the early stages of their growth—in the form, for example, of telegraph and hop-poles, etc. The revenue from forests composed of coniferous and broad-leaved trees mixed together lay between these two. But, of course, this is not an universal rule; for a high-forest of beech might yield a better return than a coppice with oak standards, and a similar comparison might be made between forests stocked with other trees of different relative values, and managed under various systems. The following figures, showing the results of sales in the Nancy conservatorship, will serve to illustrate what has been said:—

Simple coppice,	yielded	4s. 4d.	per acre.
Coppice under standards,	,,	11s. 8d.	,,
High-forest of broad-leaved species,	,,	13s. 1d.	,,
High-forest of coniferous and broad-leaved species,	,,	23s. 10d.	,,
High-forest of coniferous species,	,,	51s. 6d.	,,

Looking, then, at the larger proportion of the communal forests which is under coppice, and at the relatively greater proportion of firewood and timber of small size that they consequently produce, the smaller gross revenue per acre that they were able to yield is no longer surprising. Taking the State and the communal forests together, it was found that their gross revenue was 22 per cent.

per acre higher than that of the private forests notwithstanding that these latter are, as a rule, on better soil, and are frequently grown under other more favourable natural conditions.

The average all-round rate actually realised in the State forests per load of wood of all sorts, including tanning bark, was 14s. 5d.; while that obtained in the communal forests was only 9s. 8d. The corresponding rate for the whole of the French forests, including those belonging to private proprietors, was 10s. 7d.; so that the rate in the State forests exceeded the general average by 37 per cent., while that in the communal forests fell to 9 per cent. below it. The revenue obtained by the sale of minor produce was derived principally from shooting leases and permits.

It is not an easy matter to determine the capital value of a forest, but in 1873 an estimate was made, which put that of the State forests at nearly 50½ million pounds sterling, which is equivalent to a little over £50 per acre. The gross revenue derived from them in that year represented a return of 3·15 per cent., but the net profit did not much exceed 2 per cent. on the estimated value. The capital value of the communal forests is certainly less per acre than that of the State forests, on account of the younger age at which the trees are, generally speaking, cut; and, notwithstanding that their revenue is smaller, it is probable that they pay a higher rate of interest than the State forests.

It has been estimated that the relative rates of interest on their capital value paid by forests in which the main crop is removed at various ages, is something like the following, viz. :—

Age,	. .	25 years,	. .	4	per cent.
,,	. .	30 ,,	. .	3½	,,
,,	. .	40 ,,	. .	3	,,
,,	. .	60 ,,	. .	2	,,
,,	. .	100 ,,	. .	1	,,
,,	. .	200 ,,	. .	½	,,

These figures are intended to give a general idea of the manner in which, notwithstanding the increased value of the produce, the relative rate of interest declines as the age to which the trees are left standing is prolonged. They have no claim to absolute accuracy, even as representing the average of French forests, and still less can they be assumed to apply to the forests of other countries. They serve, however, to explain what has been previously said, viz., that on account of the higher rate of interest which coppice,

generally speaking, yields, as well as for other reasons, it is a more suitable system for communes than high-forest; and this remark applies with equal or even greater force to private forests.

Rights of User.

The principal rights of user are those relating to timber, firewood, and grazing; but there is also a small number of others, such as those which permit the cutting of turf, the collection of dead leaves, and the like injurious practices. In the State forests, the right-holders are, almost without exception, village communities; the instances in which private persons possess rights in them being extremely rare. The communal forests are, comparatively speaking, free from such burdens.

The law of 1827 provided for the investigation and disposal of all claims to exercise rights in the State forests, and barred the acquisition in them of any fresh ones. Hence those only have now to be dealt with, which have been formally admitted and recorded in favour of the communities or persons who possess them.

The aim of the Department has always been to free the forests from such claims as far as possible, and the law provides for this being done in the following manner, viz., all rights of *wood* may be commuted by surrendering possession of a portion of the forest itself in lieu of them, the terms being arranged by mutual consent, or, in case of disagreement, by the Courts; but the State alone can *demand* such a commutation, the right-holder cannot do so. Other rights, including those of pasture, cannot be got rid of in the above manner, but the State can buy them out by the payment of a sum of money, the amount of which is either settled by mutual agreement or by the Courts. The sale of pasture rights cannot, however, be enforced in places where their exercise is absolutely necessary for the inhabitants, the question of such necessity being, in case of dispute, referred to the *Conseil de Préfecture*,[1] subject to an appeal to the *Conseil d'Etat*.[2] The law also provides that the exercise of all rights, which have not been got rid of in either of the above ways, may be reduced by the Forest Department with reference to the condition of the forests, and the mean annual production of the material in respect of which they exist; and none can be exercised

[1] An administrative tribunal, established in each Department of France.

[2] The central administrative tribunal, established at Paris for hearing appeals from the decisions of the *Conseils de Préfecture*.

otherwise than in accordance with the provisions of the law and the rules based on it.

The principal features of the legislation regarding the exercise of wood-rights are the following, viz. :—No wood can be taken which has not been formally made over by the Forest Department ; persons who possess a right to dead-fallen wood cannot employ hooks or iron instruments of any sort in its collection ; when firewood is made over standing in the forest, it is felled, cut up, and taken out by a contractor, selected and paid by the right-holders, but previously approved by the Forest Department ; the partition of the wood among the inhabitants cannot be made until the work is entirely completed ; the contractor is responsible in all respects as if he had been the purchaser of the produce, but he acts under the pecuniary guarantee of the body of right-holders, who cannot barter nor sell the wood made over to them, nor put it to any use other than that for which it is given to them ; timber made over in satisfaction of a right, but not used within a period of two years, may be reclaimed by the Forest Department.

No right can exist to take goats into either the State or the communal forests, as the grazing of these animals is considered incompatible with the maintenance of the ground under wood. The old laws suppressed, without compensation to the right-holders, the practice of grazing sheep in the forests of the ancient royal domain of France, and the law of 1827 suppressed it also, on payment of compensation, in those State forests which are of more recent origin ; but the Government has the power to permit sheep-grazing in certain localities as an exceptional and temporary measure. No right to pasture any kind of animals can be exercised in any part of a forest not declared out of danger by the Forest Department, which has also the power to limit the number of animals to be admitted, and the period during which they may graze, with reference to the condition of the forest and the quantity of grass in it. Right-holders can only pasture animals which they keep for their own use, not those which they keep for sale.

On the 1st January 1877, about one-half of the total area of the State forests was burdened with rights of the estimated annual value of £38,400, while only ·3 per cent. of the communal forests were so burdened, the annual value in their case being estimated at £6700. The commutation and purchase of rights, which was commenced in a systematic manner in 1857, is effected by the officers of the ordinary service, as well as by those who are charged with

the framing of the working plans. As a general rule, the arrangement with the right-holders is made by mutual consent, appeals to the Courts being of rare occurrence. The State is in no hurry to spend large sums in the purchase of grazing-rights, which will probably disappear with the progress of agriculture; a result which has already been realised in the north of France, where the greater portion of these rights has lapsed through failure to exercise them.

Grazing.

Goats, sheep, and cattle have always been the enemies of forests, and they are indeed the principal agents of their destruction, especially in hot and dry climates, where the vegetation is not sufficiently vigorous to resist the effects of over-grazing.

Animals are admitted to the forests under three different conditions, viz.:—

(*a.*) In virtue of a right of user.

(*b.*) As a means of raising revenue, and of utilising the grass.

(*c.*) By tolerance, as a temporary arrangement.

Grazing by Right.—This has been treated of in the preceding section.

Grazing as a means of Revenue and of utilising the Grass.—Neither goats nor sheep are admitted into the State or communal forests with this object. In the State forests it is sometimes the custom to allow cottagers living near the forest to graze their cattle in exchange for a number of days' work, but this is not done to any important extent. In these forests, in fact, very little grazing is sold, for the practice can only be permitted in the unwooded portions, which are rarely available for the purpose, because, although they are of considerable extent (about 450 square miles), they are either required as grazing grounds for the cattle of right-holders, or they are being planted up, and hence the revenue from this source is insignificant. It was only £360 during the last year for which the record is available. But it is otherwise in the case of the communal forests, where local custom often necessitates the maintenance as pasture land of blanks, which could otherwise be most advantageously filled up; and some communes derive almost their entire revenue from this source. The receipts by them amounted in the same year to nearly £15,000.

Grazing by tolerance.—It has been said that no right can exist to graze either goats or sheep in the State or communal forests;

and the inhabitants of the communes are specially prohibited by law from admitting their own goats and sheep into their forests; but the Government has the power to sanction the grazing of sheep (not goats) in certain localities under exceptional circumstances. Permission to drive sheep into the State forests is, however, very rarely accorded, except in seasons of extraordinary draught, when the flocks of the neighbouring communes are sometimes admitted for a single season. But in the case of the communal forests, such temporary sanction is, of necessity, more freely accorded; for the forests belong to the inhabitants; and even though their true interests might be better served by keeping out their sheep entirely, it is not found possible to change their pastoral habits all at once; and, on this account, permission has frequently to be granted them to graze their sheep in their forests, either for a single year, or for periods up to five years. They can, however, graze their own horned cattle, horses, ponies, donkeys, and pigs there without special permission; and they usually do so on payment of a fee into the communal treasury. According to the latest available record, the number of animals of all kinds thus admitted in a single year was as follows, viz. :—

Horned cattle, horses, ponies, and donkeys, .	359,164
Pigs, ...	48,388
Sheep (by special sanction), ...	936,960

The animals can, however, only be grazed in places which have been declared out of danger by the forest officers, and their numbers can be limited with reference to the quantity of grass available; but it is not always possible to enforce these restrictions rigidly; and the forests, in certain regions, have much to contend with, from the extent to which grazing is practised. The receipts by the communal treasuries on this account, have been estimated at 4s. 6d. per head of large cattle, 3s. 11d. per pig, and 1s. per sheep; but this only represents an average revenue of 10d. per acre of the area grazed over, whereas wood yields, on an average, about 8s. 4d. per acre; and it seems probable that this consideration may gradually lead, in the agricultural districts at any rate, to the abandonment of the practise of pasturing cattle on forest lands. There is no doubt that when the grazing, even of large cattle, is permitted, it is carried on at the expense of the crop of wood; and that where it is practised to any considerable extent, the forest, properly so called,

tends to disappear; and this is notably the case where, for the time being, local circumstances, such as the absence of export roads, render wood a less profitable crop than grass. Here the forests gradually become almost unproductive, and finally succumb from excessive grazing.

About four-fifths of the total area of the communal forests are still used as grazing grounds, nearly one-half of the latter being open each year; and the average area provided for each class of animals is about 3 acres per head of large cattle, 2 acres per pig, and $\frac{3}{5}$ of an acre per sheep. Separate grazing grounds are allotted for each class, and these figures represent the average of all qualities of pasture land; they could not therefore, even supposing that the grazing were not excessive, be taken as a guide to the area which should be provided per head in any particular locality, even in France, and still less so in other countries.

Offences.

Until the year 1859, persons who were charged with offences against the Forest Law had always to be tried by the Courts; but in that year a law was passed which enabled the Forest Department to take compensation from offenders instead of bringing them before the tribunals, and this method of dealing with them is now largely practised. The department has always the power to charge the delinquents before the Courts; while they, on the other hand, have always the right to refuse payment of the compensation demanded, and thus to bring about their formal trial. Officers of lower rank than that of conservator are not, however, authorised to deal with cases in this manner, and the power of the conservator is limited to the acceptance by way of compensation of sums not exceeding £40; if it is desired to exact a larger amount, the sanction of Government must be obtained.

This system has many advantages. For while it is necessary in the public interest that infractions of the forest rules should be checked, a large proportion of them are usually of a petty nature, and in many cases the persons who commit them hardly deserve the severer penalties that must be inflicted on their being found guilty by the Courts. The system of taking compensation, on the other hand, permits the adoption of a scale of punishment more suited to this class of offenders, while it at the same time enables the means of the delinquents, and the attendant circumstances of each case, to be

taken into account. The punishment can also be made to follow promptly the committal of the offence, without the necessity for dragging the accused and the witnesses from their occupations to attend before a tribunal, the time of which is thus not occupied in the trial of these petty cases. The present system is easy and simple for the Forest Department; and that it acts very leniently on the population living near the forests will be seen, when it is stated that the amount of compensation exacted during the last year for which the record has been prepared, amounted to only one-fifth of the sum which the Courts must have awarded had the offenders been proved guilty before them. Occasionally the compensation is allowed to be paid in the form of a number of days' work done in the forest.

With the advancing prosperity of the country, forest offences become less frequent, and the number committed annually is very much smaller now than it used to be a few years ago. It is worthy of remark that they are more than twice as numerous in the communal as in the State forests, probably because individual inhabitants of the communes think that there is not much harm in committing minor depredations on property which they doubtless regard as their own. During the year 1876, the number of offences was 26,377, there being 3 per 1000 acres in the State forests, and 7 per 1000 acres in those belonging to the communes. More than half of the offences were connected with the theft of wood or injury to trees, and nearly a quarter related to pasture and cattle trespass, 31,231 persons being involved in the charges. As might be expected, wood-stealing is more prevalent in winter than in summer, while the reverse is the case with regard to breaches of the grazing laws. Of the total number of charges made in 1876, 7 per cent. were abandoned, either owing to the trivial nature of the offences, or owing to want of sufficient evidence; 70 per cent. were dealt with under the compensation law; and the remaining 23 per cent. were taken into court, convictions being obtained in 99 per cent. of these cases.

In addition to clauses dealing directly with wood thefts, illicit grazing, and other fraudulent practices, the Forest Law provides that no person having cutting instruments in his hand can leave the ordinary roads which pass through the forest, and that no fire can be either lit or carried within, or at a less distance than 200 yards from, any forest boundary. A regular tariff exists which fixes the penalties for damaging trees of various ages and species. The

law also prohibits the erection, without permission, of brick-works or lime kilns, carpenters' shops, timber-yards, or sawmills, within certain distances of the forest. At the time that the law was passed, it was much more necessary than it is at present to check the erection of such buildings, and applications for permission to construct them are now usually accorded on suitable conditions.

Injuries Caused by Wild Animals and Insects, Storms and Fires.

Wild Animals and Insects.—The principal wild animals which cause injury to the forests, either by devouring the seed or the young seedlings, or by peeling the bark off the young plants, are deer, pigs, hares, and rabbits. The insects which attack the leaves, the bark, and even the wood of the trees, belong chiefly to the families *Coleoptera*, *Lepidoptera*, and *Hymenoptera*. But the damage done is not excessive, and it is, in fact, far less than that produced by the same causes in many other countries. It is of course exceedingly difficult to put a money value upon injuries of this sort, which include not only the actual death of a certain number of old and young trees, but also a reduction in the rate of growth of others. An estimate was, however, made regarding the damage done in 1876, and it is said to have amounted to about 4s. per 100 acres, taken on the entire area of the State and communal forests. The coniferous trees generally suffer more than the broad-leaved species, as they are more exposed to the attacks of insects, which not infrequently kill them outright, whereas the latter species more often suffer merely a diminution in their rate of increase.

Storms.—The damage done by storms of wind is a much more serious matter. Injuries are caused to the forest by them, which it is not always possible, either to prevent, or even to modify. In the first place, the windfalls interfere with the arrangements laid down in the working plan, and the considerations which guide the execution of the fellings are thus thrown out; they remove too large a proportion of the seed-bearing trees, and consequently it is sometimes necessary to substitute a difficult and costly artificial process for the natural regeneration, which would otherwise have been effected; while, in addition to this, they break, or otherwise damage, neighbouring trees by their fall. In the second place, the value of the windfalls themselves is, speaking generally, small, as they are frequently broken or otherwise injured, while

most of them have probably not attained the age or dimensions at which it was intended that they should be felled. They are also specially liable to attacks by insects, which often appear in large numbers in forests where many trees have been blown down, particularly in the case of the coniferous species. Even uninjured windfalls fetch a lower price than trees felled in the regular manner, because they are usually found scattered here and there, instead of being concentrated in one part of the forest.

The year 1876, which is the last for which figures can be obtained, was a disastrous one, the amount of windfalls being exceptionally large, probably double of that which occurs during an average year. The number was put at 1,145,708 trees, and the damage caused was estimated at £10,300, or about £3, 4s. per 100 acres in the State forests, and 12s. per 100 acres in those belonging to village communities. The latter being, for the most part, coppice under standards, suffered less than the former, while the proportion of windfalls in the coniferous forests was greater than that in those composed of broad-leaved species. The windfalls were sold for nearly £621,000.

The forest officers, when arranging the annual fellings, are careful to provide, as far as possible, against the effect of storms, by leaving a protecting belt of trees standing on the side of the forest from which the dangerous winds blow, and in other ways; but much depends on natural conditions which are beyond their control, such as the configuration of the ground, the shelter afforded by neighbouring hills, the nature of the soil and its physical condition, the kinds of trees and their root development, as well as their size, age, and the system of treatment to which they have been subjected.

It may be added that hailstorms often do great damage by stripping the trees of their foliage, and by breaking or otherwise injuring the young plants.

Fires.—The Penal code provides for the punishment of persons who cause forest fires either intentionally or through carelessness; and the forest law prohibits the lighting or carrying of fire either inside the forests or within 200 yards of their boundaries; but the ordinary laws do not prevent proprietors from lighting fires in their own forests to the danger of their neighbour's property. This is an important question in the Maures and Esterel,[1] where the bad practice is followed of systematically lighting fires in the forests, in order to burn up the heather and other shrubs which interfere with

[1] Low mountain ranges in the south of France.

the regeneration of the crop of trees; and in 1870, a special law was passed, prohibiting the proprietors of those districts from lighting fires in their forests, except at seasons fixed by the Prefect; and also compelling them to clear fire-lines round all woods and forests which have not been completely freed from all inflammable shrubs.

In 1876 there were 290 fires in the area managed by the Forest Department, nearly all of them being the result of accident. The surface burnt over measured 2350 acres, or about $\frac{1}{3000}$ part of the entire area, and the damaged was estimated at £3280, or 28s. per acre of forest burnt. The proportion of fires was greater in the broad-leaved than in the coniferous forests; but, on the other hand, the amount of damage done per acre in the latter, was three times as great as that in the former, the resin in the trees themselves, and in the dead needles on the ground, rendering the fir and pine forests excessively inflammable. It is also worthy of remark that, although, as a general rule, fires were of more frequent occurrence in the spring than at any other season of the year, the autumn fires were, on account of the recently fallen leaves, by far the most destructive. But this is by no means true of all regions, and the general result may be mainly ascribed to the great damage done by fires occurring during the autumn in the south of France. In the north, forest fires are of small importance, and occasion little damage.

Hunting and Shooting.

The right to hunt and shoot in the State forests is, generally speaking, let out on nine years' leases, which are sold by public auction under the rules for the sale of timber and other forest produce; but when this is not possible, it is sold by means of annual permits issued under the direct authority of the Minister of Agriculture, the sport being always carried on under the surveillance of the officers of the Forest Department. No forest officer can become a lessee of the shooting within the limits of his own charge, and forest guards are never permitted to shoot in the forests under any circumstances.

The municipal councils are, subject to the approval of the Prefect, free to dispose of the right to hunt or shoot in their forests in any manner that they wish.

Destruction of Wolves.

The destruction of wolves, boars, and other animals which are considered dangerous or harmful, is entrusted to a corps of 410

Lieutenants de Louveterie (Wolf-hunters). These officers, who are unpaid, but have the right to wear a handsome uniform, are under the control of the Conservator of Forests, and are appointed by the Prefect, on his recommendation. They are, as a rule, landed proprietors, who accept their appointment for the sake of the sport it affords them. They are obliged to keep bloodhounds and packs of dogs, and are charged to organise and direct, in communication with the local forest officers, the *battues* which are, from time to time, ordered to take place in the forests. But as this system has not been found a very efficient one, a law has recently been passed under which a reward, varying from £1, 12s. to £7, is payable to any one who kills a wolf; and the mayors are authorised, when the snow is on the ground, to organise *battues* for the destruction of wolves, boars, and other animals, anywhere within the limits of their respective communes, on condition only that they give due notice to the proprietors of the land on which the beat is to take place. The rewards paid for killing wolves amount to about £4000 a year.

CHAPTER III.

AFFORESTATION WORKS.

Works Undertaken for the Consolidation and Protection of Unstable Mountain Slopes.

Excessive grazing, both by local herds and flocks principally of sheep and goats, as well as by vast numbers of these animals which are annually driven up from the plains to the hill pastures, have produced complete denudation over very large areas; and have thus caused incalculable damage in the great mountain regions of France, principally in the southern Alps, and in the level country below them. They eat down the grass to the level of the ground, and then tear out the very roots, breaking up the surface of the soil, and rendering it liable to be washed down by the rain. These hills are of a loose formation, the strata being contorted and dislocated to a remarkable degree, and as soon as the soil is deprived of its protective covering of trees, shrubs, and herbs, whose roots held it together, the slipping and falling

of the mountain-sides is produced with a constantly increasing intensity. The rain-water, no longer interrupted in its fall, retained by the spongy vegetable mould, nor hindered in its downward flow by the thousands of obstacles which a living covering would oppose to its progress, flows off the surface of the ground with extraordinary rapidity, and, carrying with it large quantities of loose soil, suddenly fills up the torrent beds. These latter, scoured out by the rush of water, charged with mud, stones, and rocks, cut their way deeper and deeper into the mountains; and their banks, deprived of support at the base, fall inwards, the *débris* being borne onwards to the level ground below. The cracks and slips occasioned in this manner extend to a great distance on either side of the torrent, especially on the side on which the strata slope towards it, and the effect is much increased when the upper layer of rock is loose, and lies upon an impermeable bed; the water then saturates the loose rock, and, penetrating through it, and through the cracks and fissures, flows over the hard surface, the superincumbent mass being precipitated, either suddenly or by slow degrees, into the valley below. The same effect is produced in the whole net-work of watercourses, both principal and tributary, which traverse the mountain-sides; the upper strata, over enormous areas, with fields, houses, and even entire villages, being carried down into the valleys, and the whole region, which presents little to the eye but a series of unstable slopes of black marl, has an indescribably desolate appearance. It may be added that when the hill-sides are covered with trees, the snow, which has accumulated during the winter months, disappears gradually under the influence of the milder temperature which accompanies the advancing spring; but when the trees have been removed, and the masses of snow are consequently exposed to the full force of the sun's rays, they melt rapidly, and produce results on the mountain-sides similar to those which follow the occurrence of heavy storms of rain.

But the damage does not stop here, for on reaching the comparatively level valleys which form the main lines of drainage of the mountain range, the stones, gravel, and sand, transported by the numerous torrents are deposited. These valleys being usually very fertile, are occupied by fields, villages, and towns, which are connected by roads and sometimes by railways, constructed with many bridges, retaining walls, and other masonry-works; and as, by degrees, enormous areas become covered with *débris*—sometimes this result is produced suddenly and without warning—the

buildings are either thrown down or overwhelmed, the railways and roads are blocked, and the bridges are overthrown, while the fields are completely and irretrievably destroyed. The damage thus caused is most serious, both in its nature and extent; and to it must be added the great inconvenience and loss occasioned by the interruption of traffic on the roads and railways. But this is not all. If the *débris* transported by the torrent is carried into the river before it can be deposited, it is either borne on at once and thrown on to the level country lower down, or it remains, and turns the course of the stream over the fields and buildings on its opposite bank. Occasionally the deposit temporarily blocks up the valley, and causes the inundation of villages and fields on the upper side of the barrier; and when this latter ultimately gives way, the most disastrous results ensue, both in the lower part of the valley, and in the open country at the foot of the mountain range. It is to mitigate these terrible evils that the vast enterprise of afforesting the mountains has been undertaken as the only means of dealing with them. But, owing to the enormous cost of the works, it cannot be hoped that the forests thus raised will ever prove directly remunerative, and their creation, with a view to their ever becoming so, could not for a moment be justified.

The works are of two classes, viz.: (*Firstly*), The treatment of the torrent beds by a series of weirs and other structures, destined to bring them gradually, and by successive stages, to a normal slope, and thus, not only to prevent "scour," but, by the filling up and widening of the beds behind the weirs, to afford support to the unstable sloping sides, and thus gradually to consolidate them, with a view to their being ultimately planted up. (*Secondly*), The immediate planting up of all areas, the surface of which does not seem likely to be washed down within the period occupied by the construction in that locality of the first class of works. A commencement was made in 1860; but the law passed in that year not having been found sufficient, a new law came into force in 1882, which provides both for the works to be undertaken directly by the State, and for those to be executed by the proprietors of the ground, with or without State aid, as well as for simple measures of prevention.

Works undertaken by the State.—The proposal to take up ground for this purpose emanates from the Forest Department, and is followed by a formal enquiry, under the direction of the Prefect, into the circumstances of the case, regarding which a special com-

mission, with a forest officer as one of its members, makes a report. If the proposal is approved, a law is passed declaring the work to be one of public utility, and under it the ground with all existing rights, either of the proprietor or of other persons in it, is bought by the State, either by mutual agreement or by expropriation. The area is then under the forest law, and the works are undertaken at the public cost.

Works undertaken by the proprietors.—If, however, the proprietors, who are for the most part village communities, do not desire to part with the land, they must, before the expropriation has been ordered, agree to execute the specified works themselves, within a fixed time, and to maintain them, under the control of the Forest Department. In some cases, but not always, pecuniary aid is then afforded to them. If the proprietors of land outside the areas which are taken up for treatment as works of public utility, desire to undertake measures for the consolidation of the soil, or for the improvement of their pastures, they can obtain assistance from the State in the way of money, seeds, plants, or of work done for them; but when any such aid is afforded, the operations are under the surveillance of the Forest Department, and in certain cases the money so advanced has to be refunded.

Preventive measures.—When the condition of the ground is not such as to warrant its being dealt with in the above manner, it may, after the same preliminary formalities as before, be closed against grazing for any period not exceeding ten years, in which case compensation is paid annually to the proprietors for their loss of the use of it. During this interval the State has the power to execute works, in order to promote the more rapid consolidation of the soil, but the nature of the property cannot be changed thereby, and the proprietor cannot be called upon to pay anything for the improvements thus effected; while if, after the lapse of ten years, it is found necessary to continue the exclusion of cattle, the State must buy the land, either by mutual agreement, or by expropriation.

But none of the measures above described would deal effectually with the situation, unless the source of the evil were at the same time attacked, by bringing the pastoral arrangements on the neighbouring hills under control, so as to avoid overgrazing; and the law therefore provides that in 313 village communities, all those in which works are undertaken being included, as well as many others, the grazing must be carried out in the manner approved by the Forest Department. The communes are therefore obliged to

submit to the Prefect, annual proposals on this subject, showing the nature and extent of their pasture lands, the portions that they propose to use during the year, the number of animals of each kind that are to graze, the roads by which they are to reach and return from the pastures, and other matters. These proposals are considered by the Forest Department, and modified if necessary. In addition to this, with a view to encourage the pastoral population of the mountains to take care of their grazing grounds, and to put a stop to abuses resulting from ignorance and from the continuance of injurious customs, the Forest Department is empowered to grant money rewards to *fruitières* (associations of cattle-owners for the manufacture of cheeses) for improvement made by them to their pastures. It is also desired to encourage, as far as possible, the substitution of cows for sheep; but the population of the mountains does not like the afforestation of their grazing grounds, and the principal reason for the offer of rewards by the State is that it is considered politic to do something to aid them in their industry, as some set off against the inconvenience to which individual communities are sometimes put by these operations.

Scope and progress of the entire work.—The total surface to be treated as a work of public utility in the Alps, Pyrenees, and Cevennes, is estimated to amount to 1035 square miles, in addition to about 1900 linear miles of torrent beds. Up to the end of 1885, 152 square miles of this surface, and 373 miles of torrent beds, had been completed; the expenditure having amounted to £819,320, and the rates having varied from £3, 2s. to £6, 3s. 6d. per acre, and from 2s. to 7s. 6d. per linear yard, of torrent bed. There remain to be treated, therefore, about 883 square miles of surface, and 1500 miles of torrent beds. In addition to the above, the State has paid £138,000, or half the cost of treating 212 square miles, as "permissive works," under the old law; and £12,000 towards pastoral improvements.

Draining and Planting of Swamps and Waste Lands.

Measures of the nature above described for the consolidation and protection of mountain slopes are undertaken in the interest of the population generally. In the case of sterile unproductive wastes or swamps, not requiring to be dealt with on these grounds, the Government has thought it better, as a general rule, to leave each proprietor free to do what he considers most to his own advantage,

confining itself to the exemption from taxes for thirty years of all lands planted up. But the State has the right to force the communes to drain their swamps and wastes, with a view to rendering them suitable either for cultivation or for the growth of trees; and when this is done, advances of funds may be made under certain conditions, one of which is that the commune has the right to surrender to the State, in satisfaction of all claims, a portion of the area not exceeding one-half.

The Dunes of the West Coast.

The winds that blow continually from the ocean on to the west coast, carry with them enormous quantities of sand, which, advancing steadily over the country at the average rate of some 14 feet per annum, in the form of moving hills called *dunes*, bury under them the fields and villages they reach. It has been calculated that nearly 90 cubic yards of sand per yard of coast line are thus annually transported inland. Works to arrest the destructive effects of this invasion of sand have been in progress since 1789; they were originally carried out under the department of Public Works, but since 1862 they have been placed under the Forest Department. The total area of the *dunes* is said to be 224,154 acres, a part of which belongs to the State, and a part to private owners, while a much smaller portion is communal property.

In exposed situations, the protective works consist of a wooden palisade, erected at a short distance above high-water mark, and destined to promote the formation of an artificial dune, with a view to prevent fresh arrivals of sand from being blown over the country. Under its shelter, seeds of various kinds, principally those of the maritime pine (*Pinus maritima*), broom, gorse, and gourbet (*Arundo arenaria*), are sown; the seeds being covered with brushwood to prevent the sand in which they are sown from moving; and the sowing is thus continued inland, in successive belts, until a crop of trees is raised on the entire area. In less exposed situations, a wattled fence is substituted for the wooden palisades. In the departments of Gironde and Landes, forests of the maritime pine have been most successfully raised in this manner, the trees being tapped for resin, and the wood of those which have been exhausted being sold for railway sleepers and other purposes. But north of the Loire the maritime pine is not sown, as in that region it does not yield a sufficient quantity of resin to repay the cost of

its introduction, and here it is sought merely to establish a crop of grass on the ground.

The law of 1810, relative to the treatment of the dunes, which is still in force, provides that the Government can order the planting up of any area which in the public interest requires to be so dealt with. When the land, or any part of it, belongs to communes or private proprietors, who cannot or do not wish to undertake the work, the State can execute it, reimbursing itself, with interest, from the subsequent yield of the forests. As soon as the money so advanced has been recovered, the land is restored to the proprietors, who are bound to maintain the works in good condition, and not to fell any trees without sanction of the Forest Department. This system of raising forests on private lands would not be likely to succeed elsewhere; but here the extremely profitable cultivation of the maritime pine, due to the large quantity of valuable resin that it yields in the hot and moist climate of the south-west littoral coast, renders it a safe transaction for the State to engage in.

Before the Forest Department took over the work in 1862, 111,787 acres had been dealt with; and the entire area has now been completed. The works have to be most scrupulously maintained, in order to prevent a recurrence of the evil.

CHAPTER IV.

ADMINISTRATIVE ORGANISATION AND DEPARTMENTAL STAFF.

Administrative Organisation.

In order to carry out the work which has been briefly described in the preceding chapters, a corps of professional foresters, composed as follows, is maintained, viz. :—

1	Director of the Forest Department.	*Superior Staff.*
9	Inspectors-general.	
39	Conservators.	
245	Inspectors.	
234	Assistant-inspectors.	
308	Sub-Assistant Inspectors (*Gardes généraux*).	
3532	*Brigadiers* (Head Guards) and Guards,	*Subordinate Staff.*

This body of officials is employed, partly in the ordinary duties of the department, as being in administrative, executive, or protective charge of the units into which the forests (including those of Algeria) are grouped, for their more efficient and convenient control; partly in special branches, such as those which are charged with the preparation of working plans, with the treatment of unstable mountains, and with the communal grazing arrangements; and partly also in the Central Offices at Paris. The following statement shows the number of officers of the superior staff employed on each kind of duty:—

	Director.	Inspectors-General.	Conservators.	Inspectors.	Assistant-Inspectors.	Sub-Assistant Inspectors.	Total
Central Offices,	1	8	...	10	12	2	33
Ordinary duties,	...	...	35	180	177	209	601
Working-plans branch,	...	...	...	15	14	6	35
Consolidation of mountain slopes,	...	...	...	15	12	49	76
Communal grazing,	...	...	...	2	2	1	5
Schools,	...	1	1	3	6	...	11[1]
Algeria,	...	...	3	17	10	37	67
Detached duty,	...	...	...	3	1	4	8
Total on active list,	1	9	39	245	234	308	836

The Central Offices at Paris.—Since 1877, the Forest Department has been under the Minister of Agriculture, instead of, as formerly, under the Minister of Finance. And the change has proved a most beneficial one; for the forests are now regarded more from the point of view of their utility in augmenting the general prosperity of the country, than from that of the money revenue they can be made to yield; and they are no longer looked upon as available for sale whenever the low state of the exchequer may seem to suggest this course, which was not seldom in olden days. The Minister of Agriculture is the President, and the Director of the Forest Department is the Vice-President, of a Council of Administration formed by the eight inspectors-general, which considers all questions submitted for the orders of Government. The Central Office is divided into seven sections, each of which deals with certain branches of the work, and is presided over

[1] Exclusive of two forest officers who have been removed from the active list as professors, and three professors who are not forest officers.

by an inspector-in-charge, who is assisted by two or three other forest officers and a number of clerks.

Ordinary Duties in the Forests.—The unit of administrative charge is the division (*inspection*) which is held by an inspector; but for purposes of executive management this charge is split up into sub-divisions (*cantonments*), under assistant or sub-assistant inspectors, who are also at the disposal of the inspector for any special work that he may require of them. Occasionally, when the division is a small one, the inspector himself holds charge of a sub-division. The divisions are grouped into conservatorships, and these again into six circles (*régions*), each of the latter being assigned to an inspector-general. The forests, State and communal, managed by the Forest Department are 11,508 square miles in extent, and they are divided into 414 sub-divisions, 192 divisions, and 35 conservatorships; consequently, the average area of each of these charges is as follows, viz.:—Sub-division, 28 square miles; division, 60 square miles; conservatorship, 329 square miles. The average area of an inspector-general's circle extends over 1918 square miles.

The sub-divisional officer is essentially an out-of-doors man, who personally directs all work going on within the limits of his charge, in accordance with the instructions given to him by the inspector, whose assistant he is, and who can at his discretion employ him on special duties outside his sub-division. The divisional officer is the manager of the forest estates. He prepares projects for the various works that are to be undertaken, and directs the subordinate officers in their execution; he is also the prosecutor in all cases taken into Court for the suppression of forest offences. The conservator exercises a general control over the divisional officers employed under him; and it is his duty to see that all work is directed in accordance with the views of the Government, as they are from time to time communicated to him from the Central Office. He alone has control of the expenditure, and has power to issue orders on the public treasury. As regards his circle, the inspector-general is not an administrative officer; but he makes an annual tour, and is required to become personally acquainted with all the work going on, and with the qualifications of all ranks of officers employed within it, seeing that each fulfils his duties properly. During the remainder of the year he is at headquarters, where he is able to make use at the council board of the information collected during his tour, by advising the Govern-

ment both in the issue of orders for works, and in the selection of officers and subordinates for promotion to fill the vacancies that may occur.

It may here be mentioned that in addition to the charge of the State and communal forests, the officers of the Department are called upon to exercise certain functions in the private forests, which will be explained hereafter.

Working Plans.—A separate branch of the Department is charged with the framing of working plans for the most important forests, those for the smaller ones being prepared by the local officers. The thirty-five inspectors, assistant and sub-assistant inspectors, who are thus employed, are divided into nineteen sections, which are at present working in twenty-four conservatorships. As the operations are concluded in one locality, the sections are moved to another. The officers are under the orders of the local conservator, who transmits their proposals to headquarters with his own opinions and recommendations.

Consolidation of Mountain Slopes.—The branch of the Department to which this vast undertaking is entrusted is presided over by an inspector-general, and is composed of seventy-six officers of the superior staff, working in eighteen centres. These officers are under the orders of the conservator within whose charge they are employed; and he transmits their projects and proposals to the inspector-general, who is thus enabled, by the exercise of his supervision, to utilise the experiences gained in the various localities for the benefit of the entire work. The inspector-general reports to the Director of the Department all matters relating to this undertaking which are to be laid before the Council of Administration.

Communal Grazing Arrangements.—The five officers who are employed in the three great mountain regions to prepare projects for the control of the communal grazing arrangements, and the issue of rewards for improvements to the pastures effected by the *fruitières* (associations for cheese-making), are placed in the same relation to the conservators as are the officers employed on the consolidation of mountain slopes.

Accounts.—It is a fundamental principle of the French system of forest administration, that the forest officers have nothing to do with either the receipt or the payment of money. They sell the produce by auction, or by the granting of permits, as the case may be; but the sums realised on account of such sales are paid by the purchasers directly into the public or communal

treasury. The inspector prepares a budget estimate for his proposed expenditure on works; and when this has been sanctioned, the various undertakings are commenced. Towards the end of each month he submits to the conservator an estimate of his proposed expenditure for the following month, during the last days of which that sum is paid to him, and he disburses it at once, transmitting the vouchers together with the unexpended balance, should there be any, to the Treasurer-General; he keeps no money in his hands. In exceptional cases, however, the conservator can grant orders for advances to the officers employed under him; but in this case they must, at the end of each month, adjust the advance by vouchers handed in to the Treasurer-General along with any balance of cash that may remain unexpended in their hands. The Treasurer-General thus keeps all the accounts, both of receipts and expenditure, of the Department.

Departmental Staff.

Members of the Forest Department are ineligible for any other office, either administrative or judicial; they are prohibited from engaging in trade, or in any industry connected with wood, and they must be regularly sworn in before they can enter upon the exercise of their functions. They have, as regards forest offences, the powers of police, including the right to make domiciliary visits for purposes of investigation, and to arrest suspected persons; but these powers are exercised chiefly by the members of the subordinate staff. Officers of the superior staff act as public prosecutors in forest cases.

Superior Staff.—Candidates for the superior staff are, as a rule, trained at the National Forest School at Nancy; but one-third of the appointments to the lowest grade (*Garde général*) are reserved for the promotion of deserving subordinates. A young forest officer, on leaving the school, is employed for a time, usually about a year, in learning his duties under an inspector; and his advancement from this probationary stage, as well as his further promotion through the higher grades, depends on his own qualifications and exertions, as reported by his immediate superiors.

A promotion list is drawn out every year by the Council of Administration, and published for general information. On it are inscribed the names of those officers of each grade who are con-

sidered to be the most deserving of immediate promotion, the number of names on the list being limited to three times the number of the anticipated vacancies. The Minister of Agriculture makes all promotions up to and including the grade of inspector, but the conservators, the inspectors-generals, and the Director of the Department are nominated by the President of the Republic. No officer can, however, be selected for promotion whose name is not found on the list, and who has not served at least two years in the lower grade.

The yearly pay of the various grades is as follows :—

Director of the Forest Department, . . .	£800
Inspectors-General, 3 Classes, ...	£480 to £600
Conservators, 4 Classes, ...	£320 to £480
Inspectors, 4 Classes, ...	£160 to £240
Assistant-Inspectors, 3 Classes, . . .	£120 to £152
Sub-Assistant-Inspectors, 3 Classes, . . .	£80 to £104
Sub-Assistant-Inspectors on Probation, . .	£60

In addition to their salaries, the officers receive travelling allowances, usually a fixed sum per annum, at various rates according to local circumstances.

A pension, at a rate which varies according to the grade of the retiring officer, is obtainable after the age of 60 years; but no inspector can become a conservator after he has passed the age of 55 years. Conservators are usually pensioned at the age of 62, and inspectors-general at 65.

Subordinate Staff.—All members of the subordinate staff must have served in the army, and, as a general rule, they must have attained the rank of non-commissioned officer; they cannot be less than 25, or more than 35, years of age at the time of their appointment. They receive their first nomination from the Minister of Agriculture, who promotes them from a list similar to that which is annually prepared for the superior staff. The scale of annual salaries is as follows, viz. :—

Head Guard, 3 Classes, . .	£36 to £44
Guard, 2 Classes, . . .	£28 and £30, with an additional £2 after 15 years' service.

They must live in or near the forests, where they are provided, as far as possible, with accommodation for themselves and their families in houses specially built for them; but if such houses are not available, they receive a lodging allowance. In addition to their

pay, they are given a fixed quantity of firewood per annum, and they are allowed to cultivate a plot of ground not exceeding 2½ acres, and to graze two cows in the forest.

Each guard has a beat which he is bound to visit daily, the average size of such charges being about 1200 to 1300 acres, or say two square miles. The head guard has four or five guards under his orders; he superintends their work, and communicates to them the instructions received by him from the sub-divisional officer. The duties of the subordinate staff are chiefly those of protection; they act as forest police, and have the power to serve summonses, as well as to arrest delinquents. They are bound to report all offences committed within their beat; and should they fail to do so, they become responsible for the payment of any fines or compensation money which might be levied from the offenders. Acting under the orders of the sub-divisional officer, they superintend all work going on within the limits of their charge; and in addition to this, they, under his direction, tend the young plants, prune the stems of the reserved trees, fill up small blanks in the forest, and perform such-like minor operations with their own hands. Rewards are given annually to men who have specially exerted themselves in this manner; but they are forbidden to accept, without special sanction, any gratuity from "communes" or private proprietors for services rendered by them in the execution of their duties. They are entitled to a pension when they have attained the age of fifty-five years, and have completed twenty-five years' service, including the time spent in the army.

As above stated, one-third of the appointments to the grade of sub-assistant inspector are reserved for the promotion of deserving members of the subordinate staff. Ordinarily, men so promoted must have at least fifteen years' service, and be less than fifty years of age; but they can be promoted after four years' service, if they have passed successfully through the secondary school at Barres.

Military Organisation.—Under the law which provides that all men belonging, in time of peace, to regularly organised public services, can, in time of war, be formed into special corps, destined to serve with the active or with the territorial army, the members of the Forest Department form a part of the military forces of the country; and the officers of the superior and the subordinate staff are organised by conservatorships into companies or sections, according to their numerical strength. In case of the mobilisation of the army, the Forest Corps is at the disposal of the War

Minister, and its various units assemble at previously determined points. The students of the Forest School at Nancy receive military instruction and are drilled, the time passed at the school counting as service with the colours. The officers of the superior staff hold rank as officers of the reserve, or of the territorial army, and in time of war may be employed either in command of the companies and sections of the Forest Corps, or otherwise as may be ordered. From the day that they are called out, the companies form an integral part of the army, and enjoy the same rights, honours, and rewards as the other troops which compose it. They are inspected by their own officers annually in time of peace, and the head-guards and guards, who form the non-commissioned officers and rank and file of the companies, enjoy at all times certain privileges as soldiers.

In virtue of this service, a military uniform is prescribed for all grades, including the students at the schools. The subordinates wear it always; and the officers do so on all ceremonial occasions, including official inspections of the forests by their superiors.

CHAPTER V.

FOREST SCHOOLS.

The Higher School at Nancy.

The Forest School at Nancy is the only one existing in France for the training of officers of the superior staff. It was founded in 1824, before which year the Department was recruited either by means of young men, often of good family, who worked gratuitously in the inspectors' offices in the hope of ultimately obtaining an appointment, or by means of retired officers of the army. Very few forest officers received, under the old system, a professional training sufficient to enable them to discharge their duties satisfactorily; and it was to remedy this state of things that the school was established. The arrangements were modest at first; but a great development has taken place during the sixty-two years that have elapsed since 1824. The present organisation of the school will now be briefly described.

The controlling and teaching staff is composed as follows, viz. :—

1 Director, with the rank of Inspector-General (Professor of Political Economy and Forest Statistics).
1 Deputy-Director (Professor of Forestry).
1 Assistant-Professor of Forestry.
1 Inspector of Studies (Professor of Law).
1 Assistant-Professor of Law.
1 Professor of Natural History.
1 Assistant-Professor of Natural History.
1 Professor of Applied Mathematics.
1 Assistant-Professor of Applied Mathematics.
1 Professor of Agriculture.
1 Professor of German.
1 Professor of Military Science.
1 Assistant-Inspector for Experiments.

All these are forest officers except the professors of agriculture, German, and military science; and none of them, except the professor of agriculture, who is Dean of the Faculty of Science at Nancy, have any other duties. The salary of the Director rises from £360 to £480, with £80 a year as sumptuary allowance. The professors of forestry, natural history, law, and applied mathematics receive, on first appointment, £80 a year in addition to the pay of their grade, whatever it may be; but if, after some years, they desire to be permanently attached to the school, they may be removed from the active list, on a salary rising from £280 to £360 a year, when they are entitled to a higher rate of pension than they would otherwise receive. The assistants take part in the instruction under the control and guidance of the professors, whom they are in training to succeed; they receive £40 a year in addition to the pay of their grade. The salaries of the professors of agriculture, German, and military science are fixed from time to time, the maximum rate being £240. The appointments of Deputy-director and Inspector of studies do not entitle their holders to any extra pay; but these officers, as well as the Director, have free quarters at the school. The staff is completed with an accountant, two adjutants (corresponding to sergeant-majors), a librarian, a gate-keeper, and other subordinates.

The Director of the school is the President, and the professors and assistants are the members, of a Council of Instruction, which assembles at the school from time to time to consider any matter which may be brought before it by the Director.

A Council sits at Paris at least once a year for the consideration of such general questions as may be brought before it, relative both to the instruction given at the Forest Schools of Nancy and Barres, and the conditions of admission to, and the regulations in force at, those institutions. *President*, the Minister of Agriculture. *Members:* A senator, a member of the *Conseil d'Etat*,[1] the Director of the Forest Department, the Director of Agriculture, the Director of Agricultural Hydraulics, an Inspector-general of forests, the Directors of the Forest Schools at Nancy and Barres, a Conservator of forests, a retired forest officer, the Director of the Agronomic Institute, a member of the National Agricultural Society, an Inspector-general of mines, a Chief engineer of naval construction, the Professor of Surveying from the Military School, and an officer of the army.

Admission to the school is obtained by public competition. Candidates must be between the ages of eighteen and twenty-two years; they must be in sound health, and hold a certificate showing that they have completed their course of general studies at the *Lycée* (High School). The subjects in which they are required to pass at the entrance examination are as follows, viz. :—Arithmetic, elementary geometry, algebra, trigonometry, analytical geometry, descriptive geometry, natural philosophy, organic and inorganic chemistry, cosmography, mechanics, the German language, history, physical and political geography, and plan-drawing. Two passed students from the Agronomic Institute, and two from the Polytechnic School, can, if otherwise qualified, be admitted every year without further examination. The number of candidates admitted annually is, as a general rule, from fifteen to eighteen, and the course of study extends over two years, so that there are from about thirty to thirty-six regular students at the school at one time. The young men, while at Nancy, are housed in the school building, but take their meals in the town. Their parents deposit £60 a year for their maintenance, including the purchase of books and instruments; but they do not pay anything for their instruction, or towards the annual expenses of the school, which may be estimated as follows, viz. :—

Salaries, scholarships, tours, and examinations, .	£4170	0	0
Maintenance of the buildings, library, museum, etc., .	742	0	0
Total annual payments by Government, .	£4912	0	0

[1] See foot-note, p. 247.

If the number of students passed annually through the school be taken as sixteen and a-half, the actual expenditure per head, for the entire period of two years' residence, is £298; but if interest at 4 per cent. on the estimated capital value of the buildings and collections (£22,000) be added, the annual expenditure becomes £5702, and the amount spent by the State on each student, during the period of his training, is raised to about £350.

Each year of study at the school comprises six and a-half months of theoretical, and two and a-half months of practical, instruction; one month being devoted to examinations, and there being two months of vacation. During the period devoted to theoretical instruction, the following subjects are taught, viz.:— *First year:* Sylviculture in all its branches; botany, including vegetable anatomy and physiology, as well as the classification of plants and their geographical distribution, special attention being paid to forest trees and shrubs; political economy, with special reference to forests; forest statistics; law, including forest laws and rules, together with such general knowledge of the common law of the country as is judged necessary; surveying and the construction of roads; the German language; military science; riding. *Second year:* Working plans or schemes of forest management; mineralogy and geology, with special reference to the chemical and physical properties of forest soils; zoology, especially the branch relating to the insects which attack trees; agriculture; buildings, including houses, saw-mills, and bridges; the treatment of torrent beds, including the construction of masonry and other weirs. The teaching of surveying, law, the German language, military science, and riding is continued. During the last month of each theoretical course, weekly excursions are made into the forest; but with the exception of this and the riding-drill the whole of the instruction is given in the class-rooms.

The practical course, which occupies two and a-half months of each year, or five months in all, consists of tours made into the forests in the neighbourhood of Nancy, as well as into those of the Vosges and Jura, and occasionally to other localities, for the purpose of studying forestry, natural history, and surveying, a part of the time being devoted to military exercises. An area of 7500 acres of forest, situated near Nancy, and placed under the Director of the school, is used as a field of practical instruction, as well as for various experiments and researches, to carry out which an assistant-inspector is attached to the staff. The subjects

dealt with by him are principally meteorology, the growing of plants in nurseries, various methods of pruning, the effects of different systems of thinning, the rate of growth of various kinds of trees living under different conditions, and many other things.

The school is well equipped in every way. Besides commodious buildings to accommodate the Director, the Deputy-director, the inspector of studies, the students, the adjutants, and other subordinates, there is a spacious amphitheatre, with halls of study; a recreation-room and an infirmary are also provided. The museum contains very complete collections, illustrating the courses of mineralogy, geology, palæontology and botany, with woods, fruits, seeds, and carefully-arranged dried specimens of the foliage and flowers of trees and other plants, as well as raw forest products. There are also stuffed mammals, birds, reptiles, and fish, and a collection of insects, with sections of wood showing the damage done by them to the trees. The school possesses an excellent professional library, comprising about 3350 volumes, and a number of maps. It has also a chemical laboratory, in which many interesting researches are made, either at the instance of the professors, or of forest officers of the ordinary service who may desire the investigation of questions which have arisen in the course of their work. There is a collection of models of saw-mills, of torrent beds treated with weirs, and of sand dunes, etc., as well as a fencing-hall and a botanical garden. It is estimated that the buildings are worth about £12,000, and that the library and other collections are worth £10,000; total, £22,000.

The students having passed out of the school at the end of their course of instruction, are appointed to the Forest Department as *Gardes généraux* (sub-assistant inspectors), and are employed on special duty for a time, before being entrusted with the charge of a sub-division.

Both Frenchmen and foreigners can obtain permission to follow the courses of the school as "free students," without the payment of any fees. Since the foundation of the school in 1824, 1334 regular students, candidates for the French Forest Service, have been received; and complete or partial training has been afforded to 239 free students, of whom 30 were Frenchmen, 73 Englishmen, and the remainder were foreigners of other countries.

The Englishmen are sent by the Secretary of State for India, to be trained for the Indian Service, under a special arrangement made with the French Government. Ordinarily the free students

merely attend the lectures, and, as a matter of course, are not examined; but the English students have to pass all the school examinations.

The Secondary and Primary Schools at Barres.

The Secondary School was established in 1883, in order to train a class of men who should occupy an intermediate position between the officers of the superior and those of the subordinate staff. Of the students who entered in that year, seventeen passed out as head-guards, and one of these has been promoted to the superior staff as a sub-assistant inspector. But the school was re-organised in 1884, and it is now maintained in order to facilitate the entrance of subordinates into the superior staff, by completing the education of such of them as may be deemed otherwise fitted for advancement. Candidates for admission to the school are selected by the conservators from among those of their head-guards and guards who are thought to possess the needful qualifications, and to be capable of passing the required educational tests; ordinarily, they must have completed four years' service in the forests, and be under 35 years of age, but passed students of the Primary School can be admitted after two years' service in the forests. They are subjected to an entrance examination in the following subjects, viz.,—dictation, elementary geometry, French history, French geography, timber measurement, the selection and marking of trees to be felled or reserved, and the duties of forest subordinates generally.

The Director of the school is a Conservator of Forests, who receives the pay of his grade and free quarters; he is aided, in the administration and teaching, by two assistant inspectors, each of whom receives an allowance of £40 a year in addition to his pay. Teachers who are not forest officers can be employed when their services are required. As is the case at Nancy, the Director and the professors form a council of instruction and discipline. The students all hold the rank and wear the uniform of a head-guard. They are lodged at the school, and receive an allowance of £2 a month to provide themselves with food and clothing.

The instruction, which extends over two years, is both general and special or technical; the object being to improve the general education of the students, and also to give them such a professional training, theoretical and practical, as may fit them for the

position they are to occupy. The course is arranged as follows, viz. :—

First Year.—Sylviculture, the cutting up and export of wood, estimates of quantity and value of timber, sales of forest produce, arithmetic and geometry, the elements of algebra and trigonometry, surveying and map-drawing, levelling, forest law, the elements of forest botany (including vegetable anatomy and physiology, and the classification of the principal forest trees), planting and sowing, and geography.

Second Year.—Working plans, buildings and roads, the elements of mineralogy, geology, and zoology, the treatment of torrents and dunes, forest law and administration, the elements of inorganic chemistry, agriculture and agricultural chemistry, literature and the geography of France. Most of the above subjects are taught, not only in the class-room, but also practically in the forest. The school is established on a property, purchased before 1873 for the Primary School from M. Vilmorin, who had raised on it a large number of exotic trees of many kinds. There is also on the estate a small forest treated as coppice under standards, which, with the State forest of Montargis, situated at a short distance from the school, is used for the practical instruction of the students. The buildings comprise the residence of the Director, the class-rooms and students' quarters, as well as a museum, containing collections to illustrate the various courses of study.

The examinations are conducted before the Director of the Forest Department, or an Inspector General deputed by him for this duty, and the students who pass will, under the new organisation, be appointed to the superior staff as sub-assistant inspectors. Like the officers trained at Nancy, they will be employed for about a year in learning their duties under an inspector, after which they will become eligible for further promotion on their merits, as are the other officers of the Department. Subordinates from the communal forests are permitted to pass into the superior grades of the Government service through this school. Nine students entered it during 1884 and 1885, and are still under instruction; eight of them having previously passed through the Primary School. One free student followed the courses for a short time in 1883.

The Primary School is a branch of the establishment at Barres, the instruction being given by the Director and Professors of the

Secondary School. It was established in 1878, for the training of young men who desired to enter the service of Government as forest guards, or that of private proprietors as guards or wood managers, there being no restriction as regards their parentage. Up to the year 1883, 148 students had passed through it into the Government service, and eight of these have since entered the Secondary School. But in 1884 the Primary School was reorganised, and it is now reserved solely for the education of the sons of forest officers and subordinates, who may desire to enter the Government service as forest guards, with a view, in most cases, of their ultimately gaining the ranks of the superior staff through the Secondary School.

Candidates must be between twenty-four and twenty-seven years of age; they must have completed their military service, and be of good character, with a sound constitution. They are obliged to pass an entrance examination in dictation, French composition, arithmetic, elementary geometry, and French history and geography. While at the school they are styled "Student Guards;" quarters are provided for them, and they receive from Government a part of their uniform, and an allowance of £1, 16s. a month to provide themselves with food and clothes.

The course occupies eleven months, and embraces the following subjects, viz., arithmetic, plane geometry, algebraical signs, surveying and levelling, the French language, French history and geography, the elements of sylviculture, the elements of forest botany (including vegetable anatomy, physiology, and the classification of the principal forest trees), and the elements of forest law and administration. The instruction is given, partly in the classrooms, and partly in the form of practical work done in the forests.

Passed students are, as vacancies occur, admitted to the Government service as forest guards of the second class; and after two years passed in the forests in that capacity, they are eligible for entrance into the Secondary School. During 1884 and 1885, however, only three students entered the Primary School, two of whom are still there, and one has received his appointment.

Free students can be admitted, with the sanction in each case of the Director of the Forest Department, but as yet none have entered the school.

CHAPTER VI.

The Private Woods and Forests of France.

Those woods and forests which are neither State nor communal property, belong principally to private proprietors, of whom the number is very great, but also partly to civil, religious, commercial, and other societies. Their extent varies of course from year to year, according as clearances are made for cultivation, or planting work is undertaken. No very exact record of the area is available, but the latest figures show it to be 23,657 square miles, or about two-thirds of the total wooded surface of France. It is probable that, at the present time, the private woodlands are being somewhat added to, rather than reduced, for it is believed that the areas annually planted up or sown, exceed in extent those which are cleared. The private forests are not entirely free from State control; while, at the same time, they are protected by the legislation almost in the same manner, and to the same extent, as are the State and communal forests. For instance, private owners, in common with the Government and the communes, enjoy the power to free their forests from wood rights, by making over a portion of the ground to the right-holders in lieu thereof; grazing rights can only be exercised in those parts of them which are declared by the Forest Department to be out of danger from the entrance of cattle, and the number of animals can be limited with reference to the supply of grass, while no right can exist to graze sheep or goats in them. Owners have also the power to free their forests of all rights, except those of wood, by the payment of compensation; and, speaking generally, it may be said that they have the same protection against injury to their property by right-holders, as is enjoyed by the State and the communes. The law also places them in the same position as regards the punishment of forest offences, including trespass by persons carrying cutting tools, cattle trespass, and the lighting or carrying of fire in or near the forests, with a claim to damages for injury caused. Proprietors can obtain for their forest guards, if they have them regularly sworn in, the same powers for the protection of their property, as are exercised by the State and the communal guards.

On the other hand, private owners cannot cut down and clear their forests, without notifying their intention to do so at least four months beforehand, and the Fores Department can, with certain

exceptions, successfully oppose the clearance, if the maintenance of the woods is desirable on any of the following grounds, viz. :—

1*st*. To protect mountain slopes.

2*d*. To protect the soil from erosion, and to prevent encroachments by rivers, streams, or torrents.

3*d*. To preserve springs and water courses.

4*th*. To protect coasts against erosion by the sea, and the encroachments of moving sand.

5*th*. For the defence of the national frontier.

6*th*. For sanitary reasons.

The Minister of Agriculture decides whether the clearance may be made or not. Between the years of 1828 and 1884, sanction has been accorded to the clearing of 1795 square miles of private woodlands, but there is no record showing what proportion of this area has actually been cleared; and it is known that sanction is sometimes obtained, merely to give an enhanced value to the property, by the removal of restrictions on it. It is worthy of remark, however, that while the average area of which the clearance was annually authorised, during the whole period above mentioned, amounted to 20,160 acres, the average during the last ten years was 5404 acres, and during the last five years it was only 3731 acres. These figures seem to show that woods are acquiring an increased value in France, and that they are cleared for cultivation to a less extent than formerly.

It has already been said that there is a special law relating to the forests of the Maures and Esterel, where fires are systematically lighted in order to get rid of the injurious undergrowth; and that, under it, private proprietors in those regions are only permitted to light forest fires at certain seasons, while they are compelled to cut fire-lines round all woods which are not completely cleared of inflammable shrubs. The manner in which the laws relating to the consolidation of mountain slopes, and the planting of the dunes, affect private owners, has also been briefly explained in a previous chapter.

What has already been said regarding the systems of culture generally adopted for the State and communal forests respectively, will lead to the correct conclusion, that those belonging to private owners, are, as a rule, treated as simple coppice, or coppice under standards, private high-forest being usually composed of coniferous trees, and situated in mountainous regions. But many of the forests that have been planted in the plains of the Landes, Sologne, and

Champagne, are stocked with coniferous species, which are frequently more suited to the local conditions, under which they yield a better revenue than could be derived from other kinds of trees. Notwithstanding that the private forests are, as a rule, more favourably situated than those owned by the State, or by communes, the gross revenue per acre derived from them is considerably less; because the trees, being cut down at a young age, yield a large proportion of timber of a small size and firewood. On the other hand, their capital value is less, and, when they are properly managed, they should give a higher rate of interest.

But unfortunately, although there are exceptions to the general rule, and some of the private forests are maintained in an excellent condition, it cannot be said that, generally speaking, they are so; for while coppice, and particularly simple coppice, is exhausting to the soil, from the young age at which the crop is cut and removed, and, in consequence of the comparative frequency with which the ground is denuded, tends to its physical deterioration, working plans are rarely prepared, and there is consequently no guarantee that the cuttings are confined within proper limits. The fellings are, in fact, too frequently, regulated according to the financial requirements of the owner, rather than by the considerations which ought to govern such operations; and hence it follows, that the condition of the private forests is not always such as could be desired. This is found to be the case in all countries; but it is probably especially so in France, where the laws relating to the division of the land on the death of its owner, and the custom of the country, tend constantly to diminish the number of large properties, and to leave in the hands of each proprietor an area of woodland too small to admit of its management on a regular system.

The produce derived from the private forests is, however, large in amount, and of very great value. Exact figures are not obtainable; but it is probable that the 26,657 square miles yield annually over 12 million loads (of 50 cubic feet) of wood, with about 270 thousand tons of tanning bark, 2250 tons of cork bark, and 30 thousand tons of resin—worth, altogether, more than £6,000,000; while the isolated trees and vines yield another 3½ million loads of wood, valued at £1,000,000. The number of foresters and guards employed in these forests is, however, comparatively speaking, very limited; this being due, in a great measure, to the small size of the individual properties, which are

consequently, in a very large number of cases, managed directly by their owners. There are no private institutions for the training of foresters and woodmen; and although the State Forest Schools are open to receive "free students," very little advantage is taken of this privilege. The Nancy School has only trained thirty such students since it was established in 1824, and the secondary and primary schools have only received one student between them. Neither the owners, nor their managers or guards, have then, as a rule, had any professional education, notwithstanding that the means of obtaining it is open to them; and it is not to be wondered at, if grave mistakes in the management of their forests are of frequent occurrence. In some places they have the means of getting a certain amount of advice from the State forest officials, who are occasionally permitted to render assistance in this manner; but they frequently attempt to imitate what is being done in the State forests, without knowing the reasons for what they see; and they are thus led to commit serious mistakes, as, for example, when, in treating a forest which is to be permanently maintained as coppice under standards, they follow the procedure adopted in a neighbouring State forest, which is undergoing conversion into high-forest. In many cases, of course, the private woods are too distant from the State or communal forests, to permit of their owners obtaining any advice or assistance from the officials of the Forest Department, and they are then thrown entirely on their own resources.

CHAPTER VII.

The Algerian Forests.

The colony of Algeria, which was conquered in 1828, is 162,000 square miles in extent, that is to say, it is about four-fifths of the size of France. It is bounded on the north by the Mediterranean Sea, on the east by Tunis, on the west by Morocco, and it extends southward into the Sahara down to the 30th degree of latitude. It is divided into three departments, viz., Oran on the West, Algiers in the centre, and Constantine on the east. The population averages only about 21 per square mile, as compared with 181 in France.

The two chains of the Atlas Mountains, which attain to a maximum height of about 7500 feet, run, roughly speaking,

parallel to the coast, but join towards the eastern limit of the territory, enclosing between them the region, about 54,000 square miles in extent, known as the "high plateau," the mean elevation of which ranges from about 2300 to 3300 feet. This tableland is rendered remarkable by the presence of numerous lakes, called *Chottes*, most of them salt, formed by the torrents which descend from the ridges on both sides, and are in flood during the rainy season. The range of hills which bounds the plateau to the north, falls away in broken spurs, which are separated by numerous valleys, to the sea, forming the fertile and hilly cultivated Tell, about 70,000 square miles in extent, which is the only part of Algeria where colonies have been established. Here the vine is largely cultivated, and excellent crops of cereals are raised. The southern slopes of the inner range descend into the Sahara, forming a region about 38,000 square miles in extent, under the sands of which, the water courses formed in the hills disappear. The desert is marked by dunes similar to those of Gascony, but is interspersed with oases which follow the course of the underground streams.

The climate near the coast is much the same as that of Provence, but somewhat hotter. As, however, the ground rises towards the crest of the first range, the temperature becomes cooler, and near the summit the air is moist, while at some seasons clouds lie on the hills and snow falls. The north and north-west winds bring rain, chiefly in the autumn and winter, the annual rainfall in the Tell being about 16 inches. The plateau receives less rain, and the distribution of it is very unfavourable, while in the desert beyond, the fall does not amount to more than 4 inches a year. The plateau is subject to very sudden changes of temperature, the south winds being burning hot, while those from the north are fresh and even cold; there are sometimes night frosts, even in summer, the daily range of temperature being occasionally as much as 70° Fahrenheit.

The forests were formerly much more extensive than they are at present. Abuse of all kinds, following on the first advance of civilisation, has led to the destruction of the greater part of them, those which remain being found on the upper slopes of the mountain chains, chiefly on the inner ranges, where the absence of roads and other means of export has hitherto rendered them almost inaccessible to wood merchants; while their distance from the cultivated part of the country has protected them from some,

at any rate, of the evils that have overtaken the forests in other localities. Some of the principal causes, that have brought about the disappearance of a large portion of the Algerian forests, are the following, viz., repeated fires, the ground being deprived of its natural covering of vegetable mould, and the ashes resulting from the burning being washed off the soil by the rain; the grazing of goats, sheep, and camels; the native practice of felling young poles, instead of using the saw to cut up the larger trees, the wood being not only used to supply local requirements, but being converted into charcoal, which, together with the bark, is exported in very large quantities; the light cover of the Aleppo pine, which occupies a great portion of the ground, and does not do much towards the improvement of the soil; the digging-up of the roots of shrubs to obtain bark and firewood; and finally the clearing of the trees from land which is totally unsuited to cultivation. This last-named cause of the disappearance of the forests has led also to the result that in many places the grass has followed the trees, and the loss of pasture land has in consequence been most serious. It is said that since the year 1870 the department of Oran has suffered a loss of one-half of its pastoral resources, while the want of a sufficient supply of wood is also much felt. Forest fires work terrible destruction in this hot and dry climate, burning up the vegetable *débris*, which would otherwise protect the ground, injuring the larger trees, and destroying the young growth; but, lately, measures have been undertaken to lessen this evil. It is said that during the twelve years from 1861 to 1873, nearly 1000 square miles of forest in the Tell were burnt, the damage done having been enormous. Fires are not of such frequent occurrence in the forests overlooking the plateau, where the chief causes of injury consist in overcutting the young trees, and in overgrazing, both of which practices date from time immemorial.

Generally speaking, it may be said that the existing forests clothe the higher portions of the two chains of hills, the ground below and between them being occupied by cultivation in the Tell, by pastures on the plateau, and by sand towards the desert. On the high portion of the Tell, the forests contain most of the trees which are indigenous in Provence, including the cork oak, which is the principal tree over a very large area, chiefly in Constantine, and is of great value; and the evergreen oak (*Quercus Ilex*), which yields excellent tanning bark, and is very common at altitudes

above 3000 feet, chiefly in Oran; while the Aleppo pine covers vast areas in all three departments. Among other trees which are also found in Provence may be mentioned the maritime pine, the ash, the elm, the poplar, and the wild olive. The Zéen oak (*Q. lusitanica*), which is not found in France, occupies a large extent of country, the most important forest of this species being that of Beni Sala, in Constantine. The Thuya (*Callitris quadrivalvis*), a coniferous tree, of which the wood is extremely valuable for cabinet-making, is also found. In localities where the forests have been destroyed, a more or less dense growth of evergreen shrubs of various families, nearly all of them characterised by thick, coriaceous leaves, has sprung up, and a palm (*Chamærops humilis*) covers a large extent of waste land.

On the hills sloping down to the plateau from the north and south, the most important trees are the Zéen oak and the cedar, the largest forests of the latter being those on the Aures, and at Belesma in Constantine, with that of Teniel-el-Had, in Algiers. The cedar (*Cedrus atlantica*) forests are usually found at altitudes above 5000 feet, but they cannot at present be worked for want of roads. The Aleppo pine, the edible oak (*Quercus Ballota*), the elm, ash, and other trees, are also found in this region. The growth of trees upon the plateau itself is extremely poor, being confined almost entirely to a species of *Zizyphus* and a *Pistacia*; but immense areas are covered with alpha grass (*Stipa tenacissima*), which is largely used for the manufacture of textiles and paper.

The following is a statement of the forest areas which now remain in Algeria:—

	Square miles.	
Managed by the Forest Department—		
State forests, ...	7604	
Communal forests, ...	300	
	——	7904
Not managed by the Forest Department—		
Communal and private forests, ...		1211
		——
		9115

This amounts to a little more than 5½ per cent. only of the total area of the country. The State forests, as well as those belonging to communes and private proprietors, are much cut up by patches of cultivated land; while about one-half of the area managed by the Department is covered with scrub, and is not worthy of the name of forest. The demarcation of the State forests is making

good progress, and in the department of Algiers it will probably be completed within the next three or four years. The cork oak is the most important tree over an area of about 2300 square miles, of which one-half is included in the State forests. Above 6000 tons-weight of cork, valued at £287,700, were exported from Algeria in 1878; and 5940 tons, valued at nearly £290,000, were exported in 1880, chiefly from private forests. The quantity will increase every year in proportion as the trees in the State forests are gradually prepared for yielding marketable cork, by the removal of their rough, natural coating, which is almost valueless. The timber cut from the forests does not suffice for local requirements, about £120,000 worth of logs and scantlings being annually imported from Sweden and other northern countries. The preparation of the cork trees in the State forests has not long been commenced, and several years must elapse before they can yield any considerable revenue; hence the gross returns from these forests are at present very small, and are far exceeded by the expenditure on them. Thus, in 1884 the expenditure was over £96,000, while the revenue did not much exceed £25,000; the heavy charges being due principally to the treatment of the cork trees, and to demarcation and survey. After a time, however, these forests will pay well; but the value they have in regulating the water-supply, and in ameliorating the climate, would, even if they had not this prospect before them in the near future, amply justify the expenditure which is now being incurred on them.

It is, of course, most desirable that such denuded areas as are unsuited for cultivation should be reafforested, and some attempts in this direction have been made; but the difficulties encountered are great, and the expense of such work is very heavy, while at the same time the closing of any portion of the scanty pastures is strongly opposed by the inhabitants. On the other hand, although the greater part of the water-courses, which are dry during the summer months, become flooded torrents during the rainy season, the results are not nearly so disastrous as those which occur in the Southern Alps; and taking all these circumstances into consideration, it has now been determined not to undertake the formation on a large scale of additional forests, but rather to devote all available funds to the improvement of those which exist. What has to be done in this direction is to protect them from fires and from over-grazing, especially by goats, sheep, and

camels; to develop a system of roads and paths, and to build houses for the forest officers and guards; to stop the practice of felling poles and young trees, and, by the introduction of the use of the saw, to promote the utilisation of large trees; to plant up blanks within the forest, and to expropriate and stock portions, at any rate, of the cultivated areas within forest limits; to purchase such of the private forests as in the public interest ought to be under State management; to regulate the grazing arrangements, improve the pastures, and develop the growth of alpha grass on the plateau; to introduce a larger proportion of species affording heavy shade, so as to improve the soil; and to encourage enterprise in the way of forest improvement among private proprietors. These measures will tend to improve the climate, and to regulate the water supply; and when, some years hence, they have advanced towards completion, it will be possible to commence the formation of new forests. In the meantime, the cultivators of the Tell have already done something to counteract the evil effects of the irregularity of the water-courses by erecting dams, constructing tanks, small canals, and other such works; and they have also planted up considerable areas of marsh land with gum trees (chiefly *Eucalyptus globulus*), which have succeeded well so far.

The law of 1881 provides that all laws and rules which obtain in France apply in Algeria, in so far as they are not contrary to local legislation; but the Governor-General has been invested with special powers, in order to avoid constant reference to the central Government at Paris. Among other local laws there is one, enacted in 1874, relative to forest fires, the principal provisions of which are as follows, viz.:—1*st*, No one, not even private proprietors in their own forests, can, between the 1st of July and the 1st of November, light or carry fire outside the houses, even for charcoal-burning or the manufacture of tar or resin, either in the interior of the forests or within two hundred yards of them. 2*d*, Neither can any one, within the same period, light shrubs, grass, or other vegetation within two and a-half miles of a forest, without special sanction. 3*d*, The native population is compelled to aid in the protection of the forests; and any persons, European or native, who, when called upon to put out a fire, refuse to assist, are liable to penalties. 4*th*, Independently of the individual penalties incurred by the actual offenders or their accomplices, the tribes can be fined collectively, when forest fires are caused by them. 5*th*, When such fires appear to have been lighted intentionally, they can be

considered as resulting from acts of insurrection, and the lands of the offending tribe can be confiscated. *6th*, After a forest, or part of one, has been burnt, right-holders cannot graze their cattle in it for at least six years.

A new law was passed in December 1885, the principal provisions of which are the following, viz. :—1*st*, All classes of proprietors can free their forests from rights of all kinds by payment of compensation, either in the form of land or money; and when estimating the value of such rights, the resources of the right-holders, on their own property, can be taken into account. 2*d*, Patches of cultivation, or other private lands, enclosed within the State or communal forests can be expropriated. 3*d*, The proprietors of cork forests, which have not been entirely cleared of shrubs, can be forced to maintain fire-lines round them. 4*th*, With certain exceptions, no private proprietor can cut down or bark his trees without sanction. 5*th*, With some exceptions, all practices which are injurious to the forests are treated under the laws relating to clearances—that is to say, they can be forbidden on certain specified grounds. 6*th*, The two last-named provisions of the law apply not only to areas covered with trees, but also in some cases to those which grow only scrub. 7*th*, Any land which in the public interest ought to be afforested can be expropriated. 8*th*, During the period (1st November to 1st July) in which the lighting of fires within or near forests is not expressly forbidden by the law of 1874, standing shrubs and grass cannot be burnt anywhere, without previous sanction being obtained.

The number of forest officers of the superior grades employed in Algeria is 67. The forests of each department form a conservatorship; but these and the subordinate charges are very much larger than similar charges in France. Their average size is as follows, viz. :—Conservatorship, 2635 square miles; division, 527 square miles; sub-division, 176 square miles; guard's beat, 38 square miles—that is to say, a guard's beat is two-thirds of the size of a French division, the other charges being in proportion.

These areas are too large, but the forests cannot afford a stronger staff at present. Until very lately the Algerian Forest Department was entirely local; but it was found that this arrangement tended to interfere with its efficiency, by impairing the status of the officers, and it is now incorporated with the General Forest Service of France.

Fig. 1.

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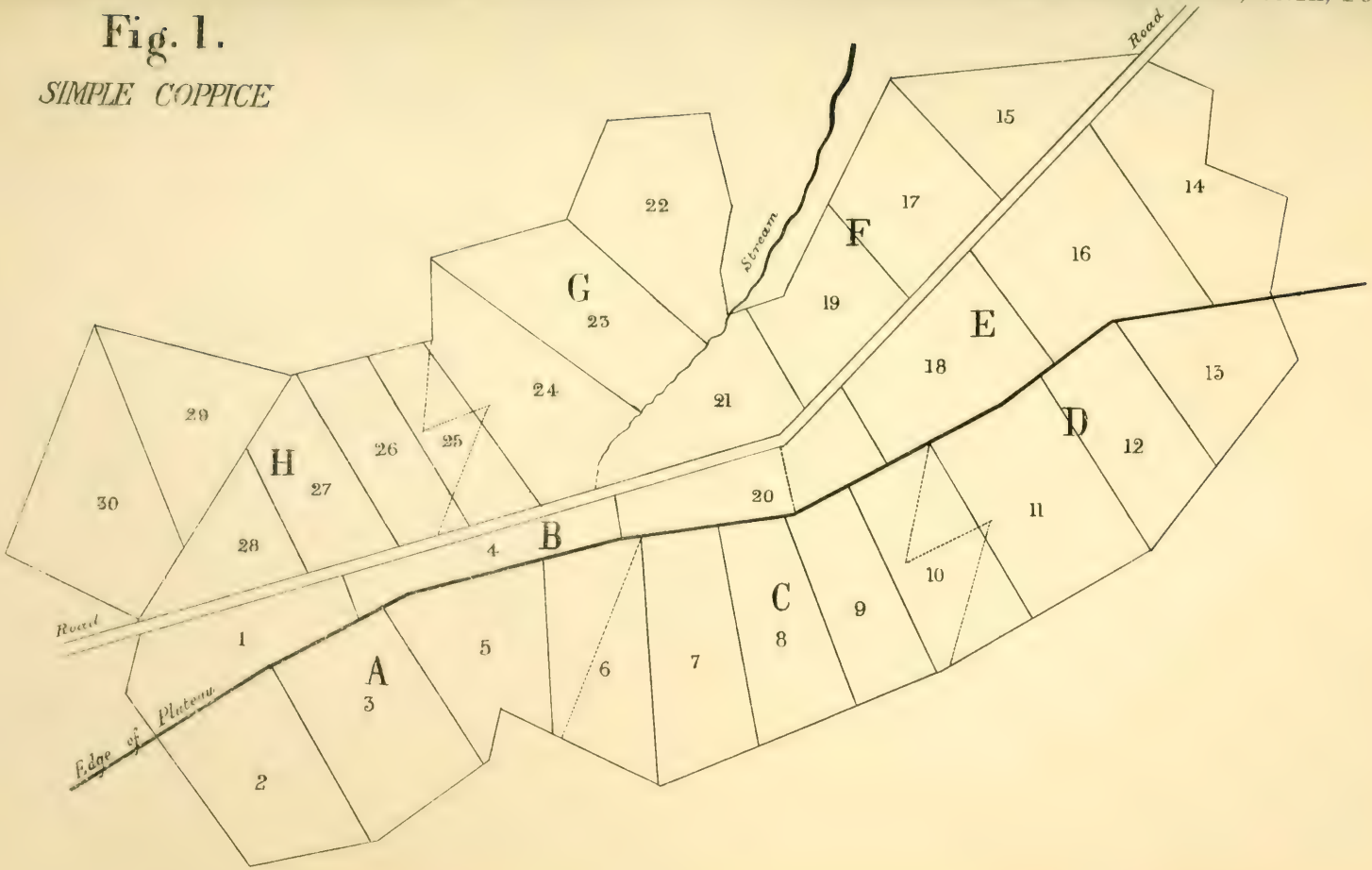


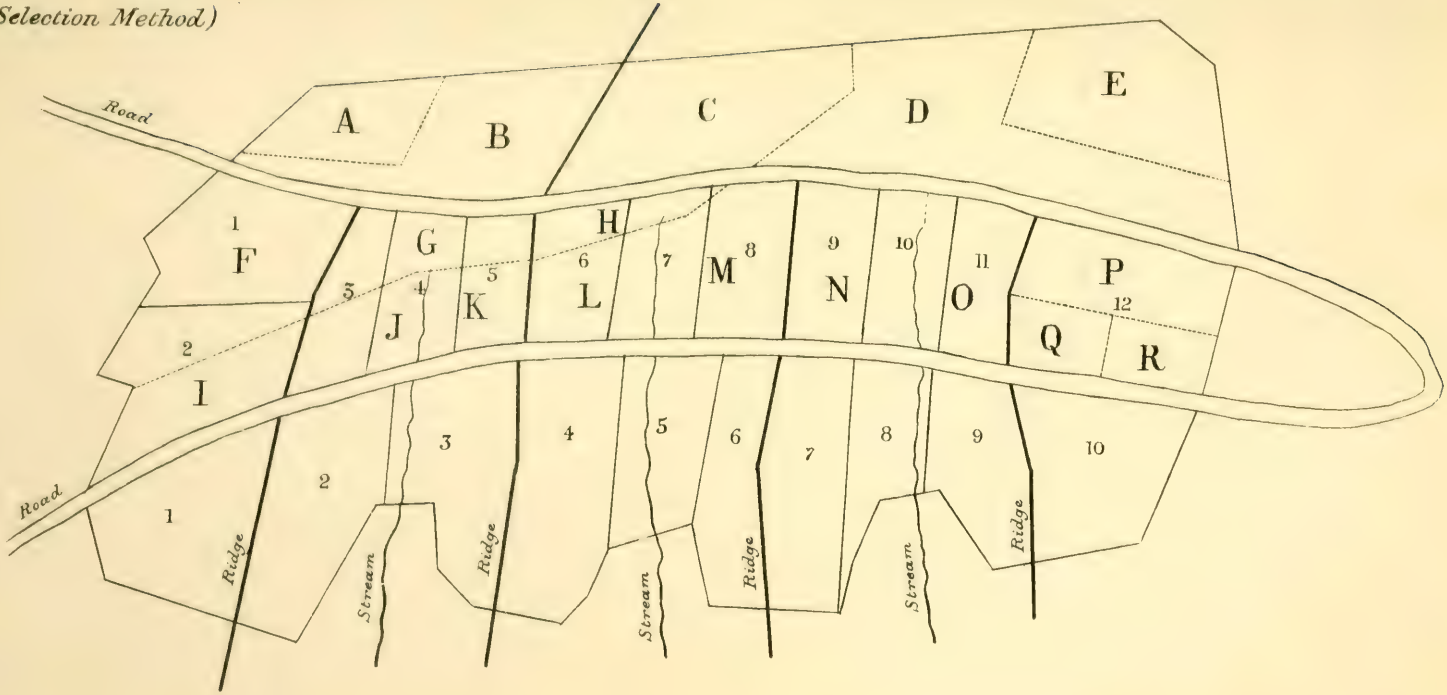
Fig. II.

HIGH FOREST
(Regular Method)

Fig. III.

HIGH FOREST

(Selection Method)



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OF THE

SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XI.—PART III.

SECRETARY AND TREASURER,
JOHN M'LAREN, JUN.,
FELLOW OF THE BOTANICAL SOCIETY, EDINBURGH.

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TRANSACTIONS

OF THE

SCOTTISH ARBORICULTURAL SOCIETY.

will doubtless render valuable assistance when Parliament meets again. We hoped that he would have favoured us with the annual address, but, as you have been informed by the Secretary, the new President is unavoidably absent on military duty.

The Society continues to fully maintain its position and numbers. There are at present—Honorary Members, 18; Life Members, 120; Ordinary Members, 600,—making a total of 738.

During the year several important additions to the Library have been received, and the collection of forest literature is now extensive and valuable, including many foreign works. The difficulty of locating the Library still remains; but the transfer of forest specimens to the Museum of Science and Art has been

The Secretary will forward the Society's Publications to Members in arrear, on receipt of a remittance for the amount due.

The ANNUAL MEETING will be held on July 26th, and the ANNUAL EXCURSION will be to BALMORAL on July 28th and 29th.

By Order.

JOHN M'LAREN, JUN.,
Secretary and Treasurer.

5 ST ANDREW SQUARE,
EDINBURGH, 28*th June* 1887.

TRANSACTIONS

OF THE

SCOTTISH ARBORICULTURAL SOCIETY.

XV. *President's Address—Delivered at the Thirty-third Annual Meeting, August* 3, 1886. By Hugh Cleghorn of Stravithie, M.D., LL.D., F.R.S.E.

Gentlemen,—In appearing before you without any formal address, I must explain that I have just returned from Germany, where urgent business detained me longer than was expected. My term of Presidency having now expired, I cannot quit the chair without expressing my sense of the honour conferred in your election of me as President at four Annual Meetings. The Society has made an excellent choice in appointing Sir Herbert Eustace Maxwell, Bart., M.P., President for the ensuing year. He is an extensive landed proprietor, and well known for his love of Arboriculture. He has been an active member of the Parliamentary Committee on Forestry during two sessions, and he will doubtless render valuable assistance when Parliament meets again. We hoped that he would have favoured us with the annual address, but, as you have been informed by the Secretary, the new President is unavoidably absent on military duty.

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completed. The second part of Vol. XI. of the *Transactions* has been issued, and the contents are of special interest, including extracts from the Report of the Select Committee of the House of Commons on Forestry, 1885; Major Bailey's excellent account of the Indian Forest School at Dehra Dún; M. Boppe's Report on the visit to the Scottish and English Forests in 1881 of Professors of the Forest School, Nancy, France; and practical papers by Messrs Webster, Glen, and Dodds.

During the past year several notable members have been removed from us by death. A few days ago the demise was announced of a distinguished Scottish forester, an original member and the first President of this Society, 1854-57—Mr James Brown, LL.D., late of Craigmill, Stirling, who died at Ontario, Canada. He was well known and highly esteemed by many of the older members, and his work, "Brown's Forester," has passed through several editions, and still is a standard work of reference. One of his sons, Mr J. E. Brown, is doing excellent work as Conservator of Forests, Adelaide, and has brought out an illustrated Forest Flora of South Australia. Among other deceased members are Mr John Ferguson, late Deputy-Conservator of Forests, Madras, Lord Waveney, and Mr Colquhoun of Luss.

The premature dissolution of Parliament having brought to a sudden close the deliberations of the Select Committee appointed to consider "whether, by the establishment of a Forest School, or otherwise, our woodlands could be rendered more remunerative"—their report, which was issued on 10th July, contained the evidence of only five witnesses—Colonel Pearson (re-examined), Dr Croumbie Brown, Dr Schlich, Inspector-General of Forests to the Government of India, Mr Julian Rogers, Secretary, Institution of Civil Engineers, and Mr Alexander Mackenzie, Superintendent, Epping Forest. The subject was pretty well threshed out, and the witnesses were all agreed on the main question, although they differed as to minor details. There was but one opinion that foresters should be instructed as to the theory of their craft. How this might be best accomplished, and where the conveniences could be best found in Great Britain for establishing a Forest School capable of imparting the special knowledge acquired in Continental schools, is still open to discussion. Dr Croumbie Brown and I spoke strongly in favour of Edinburgh. Other witnesses advocated the Agricultural Colleges at Cirencester and Downton, and Cooper's Hill Indian

Engineering College, near London. When the forest school or schools might be established was left uncertain; but that a Forest School must come, there is no doubt. In a time of extraordinary commercial depression there have been unusual obstacles to overcome, but they are being surmounted, and the day is not far distant when our foresters will have, at least, the same facilities for their proper education and training as those so long enjoyed by their Continental brethren.

Now I should like to make a few remarks on the Colonial and Indian Exhibition in London. During the last month I have been many times through that magnificent Exhibition, and have examined, more or less in detail, the wonderful display of material wealth there to be seen, including the vegetable and forest products of every colony in the British Empire. No one can visit the collection without feeling its great educative power; and one could not go away from it without having enlarged views of the magnitude of Canada, Australia, and New Zealand, and of their great economic resources and commercial wealth. The Empire of India, too, was worthily and admirably represented. Its exhibits were grouped into State Collections, and the whole Court gave one some idea of the productive power and resources of India, though the visitor might have some difficulty even after his survey in grasping the fact that the Court represented a population of 252 millions, and an area of cultivated land of 189 millions of acres. The handsome archway which formed the entrance to the Imperial Court was entirely composed of Indian timber. It had a breadth of 46 ft., and contained about 3000 specimens of useful timbers, including the index collection which we had in Edinburgh at the Forestry Exhibition. There were some splendid specimens of Padowk timber, and of bamboo probably the finest collection that had ever been brought together. Although not specially bearing upon arboriculture, a most interesting sight was the reproduction of some of the curious features of an Indian bazaar, and having spent many years in India and speaking some of its dialects, I fancied myself, when in the Court and talking to its occupants, as once again among my old Indian friends.

Turning again to the Colonies, one of the striking features of the Exhibition was undoubtedly the illustration afforded of colonial vegetation, both as exemplified in the collections of plants and flowers, and in the admirable photographs and drawings

which adorned the walls. Of these I was particularly impressed with the representations of the Australian Eucalypts and the Canadian Conifers, which were brought out in a very life-like manner. There was another point in connection with the Exhibition I desire to notice. That is the Conferences which were held frequently in the Conference Hall—occasionally two in a day and sometimes on three days a week. Many subjects of great interest were taken up. One day cinchona; another, tea; another, coffee; another, dyes; and so on. These discussions were taken part in by men of great experience, whose opinions on the subjects dealt with were of the greatest weight. I was also present at a discussion on the forests of India, when Dr Brandis, who began his work in 1855, on the Eastern side of the Bay of Bengal, gave a summary of the results of conservancy, and graphically described the progress of Forest Administration over millions of acres stretching away to the base of the Himalaya. On this occasion there were probably not more than eighty persons present, but they were nearly all experts, and in the course of a two hours' conference a large amount of useful information was elicited. Dr Brandis, who is a German, bore testimony to the wonderful progress of cultivation in the British Provinces and also in the native States, and showed that there had been great advances made in public works, such as schemes of irrigation, canals, etc. The last Conference during my visit was one on tropical fruits, in which valuable information concerning the capabilities of Jamaica was given by Mr Morris, lately of Jamaica, and now assistant director of the Royal Gardens, Kew.

In concluding, I may refer to the Handbooks and Pamphlets published by the Exhibition authorities, and which contain an immense amount of information on both Indian and Colonial subjects, and constitute in themselves a most useful library of reference. I would advise as many of our friends as can possibly do so to go to London and see it for themselves.

A FOREST TOUR AMONG THE DUNES OF GASCONY.

By Major F. Bailey, R.E.

CHAPTER I.

THE LANDES AND DUNES OF GASCONY.

(*With Map.*)

Introduction.

Our party, consisting of M. Boppe, five English students, Mr Beckington, an American gentleman interested in forest questions, M. Borel, a Swiss student, M. Takasima, and the writer, left Bordeaux early on the 26th April 1886 for Arcachon. We were accompanied by MM. de Monteil and Moyse, Inspectors, and M. Foulon, Assistant Inspector, who were so kind as to conduct us to the various points of interest we had come to study. Leaving the train at La Teste, we spent some time in going over a resin factory close to the railway station; and we then walked two miles across the dunes to Arcachon. After breakfast, we made an excursion to the Mouleau block of the forest of La Teste, and passing through it, we gained the beach, which we followed, in a southerly direction, for a considerable distance, until we reached a portion of the dunes, where a forest—which had previously been established—was sold in 1863 to a private proprietor. He has neglected to maintain the works, and the result is, that the forests are being gradually ingulfed. Our long walk home over the deep sandy track, in a heavy shower of rain, the last few miles being in almost total darkness, was the least enjoyable part of the day.

Next morning we travelled some miles by train, and then walked into a portion of the forest containing a number of old cluster pines (*Pinus pinaster*), which have been worked for resin for the last 150 or 200 years. We then walked to the village of La Teste, and caught the evening omnibus to Arcachon.

On the 28th we travelled by train to Labouheyre, where we were met by M. Mörch, Assistant Inspector, and M. Lamarque,

Garde-Général. The latter gentleman has been employed here since 1850, and has supervised the fixing and planting of 85 square miles of dunes. Accompanied by them, we drove to St Eulalie, a distance of 12½ miles, stopping on the way to look over a factory, established in the forest for the manufacture of oil from substances contained in the pine wood; and we then mounted ponies, and rode to the sea-shore for the purpose of inspecting the works that have been there erected to check the formation of the dunes. We reached Mimizan, where we were to sleep, late in the evening.

Next day we rode to another part of the sea coast to look at some works more recent than those we had previously seen, and also to study a locality in which the defences, which have been neglected, must now be partially destroyed and afterwards reconstructed. We then returned to Mimizan, and drove back to Labouheyre, where we visited a factory belonging to the railway company, in which pine sleepers and telegraph poles are impregnated with sulphate of copper. In the evening we took the train for Dax, on the banks of the Adour.

What we saw and learnt while among the dunes will now be briefly treated under the following heads, viz.:—

1. General Description.
2. Construction of the Works.
3. Treatment of the Cluster Pine.
4. Tapping for Resin.
5. Manufacture of Products.
6. Utilisation of the Wood.

General Description.

From the mouth of the Gironde down to Bayonne, a distance of some 125 miles, the western portion of the departments of Gironde and Landes forms a vast plain, about 18 or 20 miles wide, the soil of which is sandy and extremely poor. This tract of moorland (*landes*), which gives its name to the southern of the two departments, is inhabited by a population, formerly almost entirely pastoral, whose villages are scattered over it, and who cultivate scanty crops upon the fields surrounding their dwellings. But from time immemorial, and until comparatively recent years, the *landes* have been subjected to a never-ceasing invasion by sand, which, driven

over the plain from the sea-shore, in the form of moving hills, called *dunes*, has completely covered a strip of 8 or 9 miles in width, and would, if unchecked, have ultimately laid waste the entire district. The aspect of the country, before steps were taken to improve its condition, must have been uninviting in the extreme; the *lande rase*, or barren moorland, stretching towards the sea, was bounded by the *dunes blanches*, or white sandhills, which, rising near the coast to a height of some 230 feet, had already buried below them many a village spire, and their irresistible advance seemed to render certain the destruction of everything lying in their path. The church of Mimizan has been thus partially covered; and, at a short distance from the village, a mound was pointed out to us, under which lies a buried hamlet. The village church of Soulac was completely overwhelmed, but was disinterred a few years ago; and M. Lamarque told us that he often ties his horse's bridle to the top of a certain church steeple!

But this state of desolation no longer exists. The barren moor is now stocked with a nearly continuous forest of the cluster pine (*Pinus pinaster*), which, covering also the rolling dunes, has completely arrested their advance; and from various elevated points which we ascended near the coast, as well as from La Truc, in the forest of La Teste, the dark green undulating upper surface of the pine forest meets the deep blue of the western sky, and, looking landwards, there is nothing else to be seen. Indeed, throughout the many miles which we travelled by rail, by carriage, or on horseback, through this part of the country, we became weary of the monotonous appearance of these trees. They are, nevertheless, undoubtedly the saviours of the land. They not only avert the destruction of existing fields and villages, but also profitably occupy vast areas of sand-hills, and of the low-lying, marshy and unhealthy ground between them, thus providing employment for the population, who are nearly all engaged, during the summer months, in the collection of resin, and, at other times, in felling, cutting up, and exporting timber, or on other work which the forests offer to them. The people, however, still keep large flocks and herds, the guardians of which are to be seen mounted on stilts about three feet high, driving or following their animals through the dense undergrowth of prickly gorse and other shrubs.

The climate may be described as a mean between that of the Parisian and Provençal regions; the annual rainfall, of from 28 to 32 inches, being well distributed, so that the air seldom

becomes excessively dry, as it does during the summer on the shores of the Mediterranean; and thus, where the quality of the soil admits of it, a fairly varied vegetation is produced. But this condition is rarely satisfied, for the deep soil of the dunes is excessively poor, and the number of species found growing on it is extremely limited. Very few shells are found on this coast, the soil containing but little lime, and not more than from 3 to 6 per cent. of substances other than fragments of quartz. It is surprising to note what a luxuriant vegetation is produced under such circumstances. The cluster pine, which is mixed in places with a few oaks (*Q. pedunculata*), and a small proportion of other species, attains considerable dimensions; while there is a dense undergrowth, consisting of broom, gorse, heather, ferns, and other plants, which flourish on siliceous soil. On the old plain of the *landes* the sand is mixed with a considerable quantity of vegetable *débris*, and contains much iron, an impermeable stratum of ferruginous sandstone (*alios*), mixed with more or less organic matter, lying at a short distance below the surface.

The first works were undertaken here, in the year 1789, by M. Brémontier, an engineer, whose memory is honoured at Labouheyre by a bust, mounted on the same pedestal upon which, until the days of the Second Empire closed with the disasters of 1871, stood the statue of Napoleon III. *Tempora mutantur!* The Forest Department took charge of the operations in 1862. But it is certain that the cluster pine either grew spontaneously in this region, or had been introduced, long before M. Brémontier's time; for in the old part of the forest of La Teste, near Arcachon, we saw trees which must have been 200 years old, and the process of extracting resin from which had apparently been carried on for at least 150 years. This pine, which now constitutes the principal wealth of the district, is eminently adapted for the use to which it has been put; it grows splendidly on the soil and in the climate of the south-west coast, while it possesses a well-developed tap-root and strong lateral roots, which send down numerous secondary vertical roots to force their way deeply into the soil, thus holding it together, and enabling the tree to draw its supply of moisture from a considerable depth; at the same time the resin which it yields is a most valuable product. Although the cluster pine is found north of the Gironde, it is there much less vigorous and yields less resin; while in the valley of the Loire it no longer grows spontaneously, and it there loses nearly all its valuable qualities.

A special law relating to the dunes was enacted in 1810, its principal features being that the State can order the planting up of any area which, in the public interest, requires to be so dealt with; and that when the land belongs to communes or private proprietors who cannot, or do not wish to undertake the work, the State can execute it, reimbursing itself, with interest, from the subsequent yield of the forest. As soon as the money has been recovered in this manner, the land is restored to the proprietors, who are bound to maintain the works in good order, and not to fell any trees without the sanction of the Forest Department.

Construction of the Works.

The dunes are formed by the combined action of the wind and sea. Each ebb tide leaves a quantity of sand, a portion of which dries before it is covered by the next flow, and it is then liable to be blown away by the wind. The individual sand-grains, which are not, generally speaking, either sufficiently large to resist the force of the strong westerly breezes that blow from the sea towards the low plain which bounds it, nor sufficiently small to be carried away in the air in the form of dust, are driven along the surface of the ground, rarely rising to a height of more than $1\frac{1}{2}$ or 2 feet above it, until they meet with some obstacle which arrests their course, and thus promotes the formation of a little mound. Up this succeeding sand-grains are propelled, and on reaching its summit they fall down the sheltered reverse slope at a steep angle. In this manner sand-hills or *dunes*, rising sometimes to a height of 200 to 250 feet, are formed, the line of their crests being, generally speaking, perpendicular to the direction of the prevailing winds, that is, in the case of the tract between the Gironde and Bayonne, parallel to the general line of the sea-shore. This action is not completely regular. The formation of some of the dunes is commenced close to the sea, while others have their origin at some distance from it; and fresh importations of sand either add to the bulk of those already existing, or, being blown through breaks in the chain, pass on till they encounter some other obstacle. But the sand-hills themselves are kept moving slowly landwards by the wind, which drives the upper layer of sand from the gently-sloping outer face up to the summit, whence it falls down the steep slope on the landward side, and this process being continued whenever there is enough wind to produce it, the dunes are moved, or rather

rolled, inland by slow degrees; and as fresh ones are formed near the sea, which are in their turn moved onwards, it follows that, in the course of time, the whole surface of the plain has become covered with sand-hills for a distance of several miles from the coast. The rate at which the sand thus advances is very variable. Sometimes, during many months, there is no perceptible encroachment, while at others the movement is very rapid, amounting to 60 or 70 ft. in the year; the average annual rate is said to be about 14 ft. But the sand-hills do not move at an uniform rate of speed. Some, overtaking those in their front, become merged in them; while they all undergo changes of height and form, so that the whole surface of the country is continually in motion, being turned over and over to a great depth, and under these conditions it is impossible to grow anything on it. The source of the evil lies at the sea beach; and the first thing to do evidently is to stop fresh importations of sand; while as regards the dunes already formed, it will be seen from what has been said, that the movement, at any particular time, is confined to the sand then at the surface, and if this can be fixed during the time necessary to enable a crop of herbs, shrubs, and young trees to be raised upon it, the movement of the entire mass will have been arrested.

We rode from St Eulalie, through the forests, to the coast near Mimizan-les-Bains, where M. Lamarque explained to us that the system by which this is accomplished consists in promoting the formation, by the wind, of an artificial dune, close to the sea, and, generally speaking, parallel to it at high tide. This mound absorbs the fresh importations of sand; while, under its shelter, sowings are made, which, extending gradually inland in parallel bands, fix and consolidate the surface of the naturally formed sand-hills; ultimately the artificial dune is itself planted with trees, and the evil is then cured for so long a time as care is taken to maintain the works, which are commenced as follows:—

At a distance of about 165 yards from high-water mark, a wattled fence 40 in. high is erected, the pickets being driven 20 in. into the sand. This serves to arrest the sand, which is heaped up on the seaward side, a portion of it filtering through the wattles. After a time the fence is overtopped, and the sand, blown up the outer face, forms a steep slope on the other side. A second wattled fence is then erected, about 6½ ft. behind the first, and the space between the two becoming filled up, and a mound rising over it, the sand which falls over stands at a high angle against the

reverse side of the second wattle. In the centre of the mound, a palisade of planks, also 40 in. above and 20 in. below ground, is erected—the planks, which are of pine sapwood, 7 in. or 8 in. wide, and 1½ in. thick, being placed ¾ths of an inch apart. When the sand drifts up against them, a portion of it falls through the intervals, thus affording support on the other side; and when they have become nearly covered, they are raised about 2 ft. out of the ground by means of a hand-lever and chains. This operation, which we saw done, is repeated from time to time, until the barrier has attained a height of about 25 feet, when a third wattle fence is constructed, at a distance of from 5 to 6½ ft. behind the inner slope; and the top of the barrier is strengthened by means of a line of small fagots formed of pine branches, gorse, and other shrubs, which are half-buried vertically in the sand. The fagots, each of which weighs about 45 lbs., are placed at distances of 4½ feet from centre to centre. During the time that elapses before the last fence is overtopped, the palisade is not raised, so that the width of the base is increased, and the top becomes broader and rounded. When the palisade, which is now moved back a short distance, is overtopped, it is raised as before, an additional wattle being placed in rear of the work; and the building up of the mound by the action of the wind is continued in this manner, until it has attained its maximum height of from 40 to 45 ft., when its breadth is allowed to increase, until it stands on a base about 330 ft. broad. The foot of the outer slope is then about 100 ft. distant from high-water mark, the top being at least 165 ft. broad, and the slopes standing at 35 or 40 degrees. This result is usually attained in from 15 to 18 years, but the rate of the barrier's growth is by no means regular. Strong and steady west winds are the most favourable; but when the sand is raised by squalls, it is sometimes carried inland in considerable quantities. The artificial dune must be broad at the top, and its profile must be such that the most violent storms do not easily "take hold" of it; but if these conditions are fulfilled, its maintenance is easy and cheap; and if the base of the outer slope be kept at the prescribed distance from high-water mark, the sea, even if it reaches it during exceptionally bad weather, does the structure but little damage.

The surface of the mound is consolidated by fagots, 12 to 14 in. in circumference and 14 to 16 in. apart, buried vertically to a depth of 16 in. in the sand, and projecting 8 to 16 in. above ground. It is also sown with *gourbet* (*Arundo arenaria*), about

13 lbs. of seed being used per acre. This plant, which is a kind of grass,[1] with an underground stem and strong interlacing side-roots, has a remarkable power of keeping its head growing above the surface of the rising mound, the particles composing which are held firmly together by it. The sand subsequently left by the tide, either travels along the shore, or is taken up again by the sea and deposited elsewhere. An artificial dune, constructed in the manner above described, now extends along the coast for a distance of 125 miles, from the Gironde to the Adour.

As soon as the further importation of sand over the country has been arrested by the palisade, and the covering of the future plantations has thus been guarded against, the sowing of the ground in rear of it is at once undertaken. This is effected in successive parallel belts of about 20 yds. wide, commenced at a distance of 5 yds. from the line to which the inner slope of the dune will attain when it is completed. By beginning at this point, and working gradually away from the sea, the plantations are secured against injury by sand which has already passed the line of the barrier. If the sowings were begun elsewhere, they would soon be covered by the advance of the naturally-formed dunes over them.

The land to be operated upon is roughly levelled, and a mixture consisting of 11 lbs. of pine seed, 7 lbs. of broom seed, and 5 lbs. of *gourbet* per acre, is then sown on it broadcast, a palisade being erected at its inner limit, so as to prevent the seed from becoming buried under sand, carried over it by land breezes; this structure is moved back as the work progresses, so as to serve for the protection of other belts, as the sowing of each is in its turn undertaken. The sowings are carried on from October to May. The seeds are covered with branches and brushwood, laid like tiles or thatch, with their butt-ends towards the sea, and kept down by means of sand thrown upon them. The surface is thus temporarily protected, until the plants have had time to grow up and take hold of the soil. If the covering of branches is at any time disturbed by the wind, they must be at once readjusted; and should it be found that any damage has been done to the seeds or seedlings, the ground must be re-sown and re-covered with branches. The cost of the entire work is said to amount to about £8 per acre. We unfortunately did not see it in progress, but we saw some ground that had recently been treated in the manner described.

We visited the artificial dune of St. Eulalie—Mimizan, which is

[1] Syn. *Psamma arenaria*, Hooker.

now nearly completed, and M. Lamarque explained the system to us. This barrier, commenced eighteen years ago, is now about 40 feet high, and, all the ground inland having been sown, there is nothing but young pine forests to be seen as far as the eye can reach. What is now required is simply to maintain the artificial dune, which is done most scrupulously; and whenever any movement of the surface commences, fagots are at once planted, and the surface is re-sown and covered. This operation was being carried out in places during our visit, and we were assured that, if such precautions were neglected, the entire work would soon be destroyed. We saw, indeed, two instances where want of proper supervision had already produced this result. The first of these was a few miles south of Arcachon, where the land was sold, in 1863, to a private proprietor, who neglected to maintain the artificial barrier; and, consequently, a "white dune" is now in process of formation, and is gradually ingulfing the pine forest established behind it. Some endeavours have been made to arrest the movement of the sand by the erection of wattled fences inland; but these are of no avail, and the trees are being slowly but surely overwhelmed. As we mounted the new dune from the side of the sea, we found the trees more and more deeply buried; and at its summit we actually walked over the crowns of some which were completely covered. On the land side, the sand falls down in a steep natural slope, at the foot of which are seen masses of young seedlings, carpeting the ground between the older trees from which they have sprung. It is said that nothing can be done to remedy this state of affairs, on account of the conditions under which the land was sold, but special legislation seems urgently needed.

The second instance was seen a little south of the Mimizan dune, where, the subordinate in charge having neglected his work, the wind got under the covering of branches, for a distance of several hundred yards inland, and thus caused the formation of a number of large holes or pits with steep sides. If these were not dealt with, the whole forest would soon be destroyed. Matters have already gone too far to admit of mere local treatment; and the only thing to be done is to dig up the *gourbet* and other vegetable growth, and allow the artificial dune to be breached, so that the holes may be filled up by the agency of the wind that caused them. But when doing this it will be necessary to erect a wattled fence on the inner side of the damaged surface, so as to prevent

the sand from being carried too far inland. A fresh layer of sand will then deposit itself over the plantation; and when this has occurred, and the surface has thus been restored, the artificial dune must be re-formed, and the sowings re-made. We were assured that no other course is possible. This is an excellent instance, showing what incessant care and watchfulness are required to carry out an undertaking of this kind successfully.

Treatment of the Cluster Pine.

On our way from Bordeaux to Arcachon, we left the train at La Teste, and walked across the dunes to our hotel. The forest consists of pure pine, felled in some blocks at sixty years, and in others at seventy-two years, of age; but oaks (*Q. pedunculata* and *Q. Tozza*) are now being planted among the pines.

After breakfast, we visited the Mouleau block, situated at a distance of three or four miles in a southerly direction from Arcachon. Here we found that, as elsewhere, the forest had been naturally regenerated with great success, there being a dense crop of young trees, ten years old, and from 15 to 20 feet high, upon the ground. M. Boppe explained the system of treatment adopted for the cluster pine forests of this region. The tree has special requirements in the way of soil and climate; it will not grow upon limestone, and it cannot stand cold down to one or two degrees above zero (Fahrenheit), if prolonged for more than a week; neither can it be grown profitably for resin at any great distance from the sea. It is most important, in the case of this, as of other species, that before the tree is introduced into any locality a careful study should be made, in order to decide whether the conditions are such as will ensure success; and a forcible argument against the introduction of new species during extensive afforestation works is, that these conditions may not be fully known at the time. For instance, the cluster pine was extensively planted in the Sologne and in Normandy between the years 1830 and 1880; but during the unusually cold winter of 1879-80, nearly the whole of these forests, covering in the Sologne alone an area of over 300 square miles, were completely killed off.

This pine gives seed abundantly nearly every year, and its regeneration by natural means is very easy to effect. As we had previously noticed in the Maures, we found that, whenever the seed-felling had been made, there was almost invariably a plenti-

ful crop of seedlings on the ground; so that, if these could be protected against fires and grazing, the remainder of the trees might be removed, without fear of failure to obtain a fully stocked forest. The pine has long thin needles, giving very light shade, and the trees will not stand growing close together; those only which are sufficiently far apart, vigorous, and with a well-developed crown yielding resin in large quantities. Thinnings are commenced when the young trees are from six to eight years old, and are repeated every five or six years. At twenty years of age there should be from 250 to 280 stems per acre; and at thirty years, not more than from 100 to 120; this number being finally reduced to from 60 to 80, when, at the age of seventy or eighty years, the regeneration fellings are commenced. With this number on the ground, the upper or cone-bearing branches are free, but not the lower ones; these latter should be allowed to touch, so that the natural pruning of the lowest of them may be effected. In order that the extraction of resin may be successfully carried on, it is necessary that the trees should have clean stems, free of dead branches, up to a height of some 16 ft.; and in order to ensure this, it is usual, as an additional precaution, to prune away their lower branches, at the time that the first thinnings are made, that is when the young trees are not more than from six to eight years old; but this should be done carefully, avoiding the removal of too many leaves at a time, as this would check their growth.

The light cover of the pine does not afford sufficient shade to keep down the undergrowth of grass, gorse, heather, broom, ferns, and other plants, which spring up in dense masses, in proportion as the thinnings progress. These shrubs and herbs are much valued for litter and manure; and it is customary to export them, with the dead pine leaves, for these uses. This of course prevents the accumulation of vegetable mould; but on the other hand, it is said that the practice is useful to some extent, in that, when they have been removed, the resin collectors can move about the forest freely, and the risk from fires is diminished. It would, however, be much more advantageous if an undergrowth of oak (*Q. pedunculata*) could be established instead of these shrubs. M. Boppe suggested that the oaks should be planted when the pines are ten or twelve years old, at which age they have usually suppressed the shrubs that grow up with them; but M. de Monteil would prefer to put them in at the time of the seed-felling, and keep them from being choked by clearing round them. However this

may be, the introduction of the oak beneath the pine could not fail to be invaluable as a protection to the soil.

The enemies of the forests are our old acquaintances the graziers and the fires; the former, mounted on their tall stilts, driving their flocks wherever grass is to be found,—that is to say, where the young seedlings are growing. It is said that article 67 of the Forest Code (which provides that grazing rights can only be exercised in those blocks which are declared out of danger by the Forest Department) cannot be brought into force here, which seems a great pity. Fires cause very great damage; for, not only is the undergrowth of shrubs, and the mass of dead leaves and needles on the ground, extremely inflammable, but the pine trees themselves are so also. Conflagrations are sometimes caused intentionally by the shepherds, who desire to extend the area of their grazing grounds; but they are also frequently due to accidents, and it is said that they are sometimes caused by sparks from the railway engines. When they occur, they are most destructive in their effects. In passing along the railway, at a distance of a few miles from Arcachon, we saw a large tract which was completely bare, the entire forest having been burnt off it. Unfortunately there is no special legislation here, such as exists in the Maures and Esterel; and nothing can be done but to cut fire-lines from 30 to 70 ft. wide, round, and at regular intervals through, the forests, so as to divide it into blocks of 250 acres each. These lines serve as roads, and as starting points for the counter-fires, which are lighted when occasion requires it, in order to prevent the spreading of the flames. On each side of the fire-lines, as well as along the main roads and railways, the undergrowth is carefully burnt off, so as to diminish the chance of accidents; and every third year the lines themselves are dug up and all roots are extracted. This work, which is usually performed by women, whom we saw using a tool something like a large Indian hoe, costs about 5s. per acre of fire-line. The trees are sometimes attacked by a species of fungus; and it is customary to dig trenches round those which show signs of this malady, in order to prevent its spreading further.

While we were inspecting the old portion of the forest of La Teste, near Arcachon, to which allusion has previously been made, the professor explained to us that the resin is extracted from the trees, either in large quantities, so as to kill them in four or five years (*Gemmage à mort* = Tapping to death), or in comparatively

small quantities, so as not to cause their death (*Gemmage à vie* = Tapping to live). The first of these methods is adopted in all thinnings of trees aged twenty-five years and upwards, and also in the seed-felling (of which there is only one), as well as in the final felling. The operation is commenced five years before the trees are to be cut down, and is continued for four years, the trees being removed during the fifth. The principle is to take all the resin that the tree can give, leaving it exhausted at the end of the fourth year; and to effect this, many cuts or wounds are made at the same time, their number depending on the size of the tree. Sometimes there are three or four; but, in the case of large trees, there are as many as ten or a dozen, and sometimes even more. One result of this treatment, is to cause an abundant growth of seed; and this fact has great importance when the last representatives of the crop are about to be removed, for it ensures the springing up of a full crop of seedlings. The effect is similar to that produced on fruit trees, by injuries inflicted on the branches, roots, or bark, with a view to obtain an increased crop of fruit. Trees which show signs of failing from any cause, commence to produce their successors.

The second method, under which the life of the tree is to be preserved, is employed only for those trees which have been selected to form part of the final crop (*arbres de place*). They are not tapped until they have a girth of from 44 to 48 inches, which is usually attained when they are from thirty to forty years old; it is considered risky to take resin from them at a younger age. At first only one cut is opened, and it continues to run for five years, when another, on the opposite side of the tree, is commenced. Then, half way between these two, a third and a fourth cut are opened in succession, and so on; if two cuts are opened at the same time they should be at different levels, but the number should never exceed two.

The above is the improved system now in vogue. But in former years it was not the custom to tap the trees to death, and the forest we visited was particularly interesting, as enabling us to see what the effects of the old practice were. Here we saw some trees of great age, showing as many as thirty-six wounds, and doubtless there were many more the traces of which we could not detect. Such trees are probably at least from a hundred and fifty to two hundred years old. They present a most remarkable appearance, the lower 15 ft. of the stem being swelled out into a

sort of bottle shape, and consisting in some instances, of longitudinally detached fragments, through the interstices of which, light, entering on the opposite side of the tree, can be perceived. This bundle of sticks looks as if it would give way under the burden of the mighty crown which it contrives to support. M. Boppe had, however, something more important than this to which to call our attention, viz., the *effect on the forest* of this method of treatment, which, of course, since the tapping of every tree is continued until it dies, at a more or less advanced age, is almost exactly analagous to the selection method (*jardinage*). Here then was an excellent opportunity to observe the effects of this method of treating a species, which, like the cluster pine, has light cover. We certainly see a number of trees of all ages and sizes, some of them from 90 to 100 ft. high, and 12 to 13 ft. in girth; but the ground is extremely badly stocked, much of it being completely bare. When a forest is stocked with species of heavy cover, it is easy to keep trees of all ages growing together, for the taller ones do not interfere, by their shade, with the healthy growth of those which stand below them. But in the case of trees of light cover, it is impossible to obtain, by this system, anything but an extremely thin forest, for the young trees cannot maintain themselves alive under the shade of the older ones. For such species the regular system, with the age-classes grouped together, is the only one that can be successfully employed.

On our way from Arcachon to Labouheyre we passed through some private forests, in which we saw a large number of kilns for burning pine wood into charcoal; and we also inspected some ground which had, four years ago, been sown with a mixture of pine and broom, in lines 5 ft. apart. The young crop appeared to be in a flourishing condition. Near the forest house we saw some plantations of the cork oak (*Q. occidentalis*) and also of *Quercus pedunculata*. Some tea had also been sown as an experiment, but there does not appear to be much chance of its succeeding.

Tapping for Resin.

The cluster pine has large and abundant resin canals, the contents of which circulate much more freely in the sap wood than in the heart wood. In order to tap the tree, a cut, commenced near its base, is carried gradually upwards to a height of about 12½ ft., but more rarely to 15 or 16 ft., and the resin, flowing

therefrom, is collected in pots and removed to the factory. This operation will now be described more in detail. Towards the latter end of February, the dry outer bark is removed by means of a special tool (*barrasquite*) from the place where the cut is to

be made, up to a point some 4 in. higher than it will extend during the coming season. The bark is also cut off from a surface wider by about 1 in. than the cut is to be, the object being, not only to prevent fragments of falling bark from becoming mixed with the resin, but also to save the sharp edge of the tool with which the cut is subsequently to be made and renewed. Early in March the tree is again visited, and a wound of concave shape, about 4 in. wide, 2 or 3 in. high, and less than $\frac{4}{10}$ in. deep, is made into the sap wood near the ground, with a peculiarly-shaped axe (*abchotte*). Below this a small curved zinc plate is driven into the bark, and this acts as a lip, to guide the flowing resin into the earthen pot which is placed below it. The wound

runs freely for from five to eight days, when the upper portion of it is renewed by taking off a thin chip with the *abchotte*, and it is thus slightly heightened. This operation is repeated some forty times during the season, which extends to the 15th October, and by this time the cut has attained a height of 22 in. The semi-solid resin (galipot), of which the quantity is very small under this system, is scraped off by the hand of the workman from time to time; and, at the close of the season, the more hardened resin (*barras*) is removed with the *barrasquite*, and carried to the reservoir. At the beginning of the second season, the bark having been removed as before, the zinc plate is driven in at the top of the old wound, and the pot, supported below by a nail driven into the tree, is placed immediately under it. The collection is then continued as before; but when there are irregularities in the stem, or when it does not stand perpendicularly, chips of wood driven into the bark, and ingeniously arranged, guide the resin in the desired direction. The cut is increased in height by 30 in. during the second year's work, and by a similar amount during each of the third and fourth years; but during the fifth and last year the height is increased by 40 in.; and the cut having attained a total height of 12 ft. 8 in., it is abandoned, and a new one is commenced. When the tree is to be "tapped to death," the cut is made to attain its total height in four instead of in five years. The pot, which is sometimes closed with a little wooden cover, so as to reduce evaporation, is, when full, emptied into a wooden bucket, in which the resin is carried to a reservoir in the forest, whence it is subsequently conveyed to the factory in barrels, each holding 520 lbs. When the cut has risen in height, so that the workman, standing on the ground, cannot reach it with the *abchotte*, he provides himself with a sort of ladder, consisting of a notched pine pole 15 ft. long, which he places against the tree, and on which he mounts to the required height. When the pot is too high to be reached from the ground, it is removed by means of a sliding staff, which can be extended to a length of 11 ft., and is furnished with a pair of metal arms to grasp the pot; but sometimes a sharp, broad-bladed hook-like tool, something like the *barrasquite*, is fixed to the sliding staff, in addition to the metal arms, and with the aid of this instrument the cuts are renewed by the workman standing on the ground, without his being obliged to carry and mount a ladder. The method above described, which bears the name of its originator, M. Hughes, was explained to us

in detail, the whole operation being carried out in our presence. It has this great advantage, that the resin is not mixed with any large amount of foreign substances, and that, as it runs down the length of a single year's cut only, the loss by evaporation is less than formerly, when it was collected in a hole at the foot of the tree. The collection, which is usually done by contract, can also be much better carried out and supervised under the new method. It is said that a man and his wife can manage from 2500 to 3000 trees a year.

It is very difficult to give figures accurately representing the annual yield of these forests in crude resin, but it is put down at from 200 to 400 lbs. per acre, the price obtained at the factory being from 14s. 6d. to 16s. 6d. per 100 lbs. It is also stated that a tree, tapped so as not to cause its death, yields annually from 6½ to 10 lbs. of resin, a very large one having been known to give about 16 lbs. Some figures relating to last season's sales in the Gartey and Pilat blocks of the forest of La Teste may prove of interest. The right to tap and fell, within five years, 7528 trees, aged from sixty to eighty years, and constituting the final felling on an area of 118 acres, was sold for £1592. This gives nearly £13, 10s. per acre, and a little more than 4s. 2d. per tree. The yield was estimated to be 245,055 cubic feet of timber, 125,158 cubic feet (stacked) of firewood, and 2082 cwts. of crude turpentine. It must not be forgotten that the above is the revenue for the last five years only; previously to this, thinnings have been disposed of, and the trees now sold have been tapped since they were about thirty years old.

Manufacture of Resin.

When travelling from Bordeaux to Arcachon, we left the railway at La Teste to visit a resin factory close to the station.

The crude resin, brought to the factory in casks, is, notwithstanding the precautions taken, found to be mixed with a certain quantity of foreign substances, such as earth, chips, bark, leaves, insects, etc. After adding about 20 per cent. of the solidified resin (*barras*), scraped from the cuts, it is heated moderately in an open caldron, so as to bring it into a liquid state, when the heavier impurities sink to the bottom, the lighter ones rising to the surface. The liquified resin thus obtained consists of two distinct substances, viz., colophany, which is solid at the

ordinary temperature of the air; and spirit of turpentine, which is liquid and volatile, and some of which is lost if the caldron is over-heated. These two substances are separated by distillation in the following manner:—The liquid resin is allowed to run through a strainer into a retort, a small quantity of water being introduced at the same time. The rising steam carries the spirit of turpentine with it, and both are, after passing through a refrigerator, caught, in a liquid form, in a trough placed to receive them; the spirit, being lighter than the water, lies over it, and is easily drawn off. The colophany is then allowed to run out of the retort, and passing through a sieve, is caught in a vat below. Thence it is poured into flat metal dishes, and allowed to harden in the sun, under which process the finer qualities attain a delicate amber colour. But there are several classes of this substance, distinguished chiefly by their colour, which is a guide to their degree of purity, and these are known by various names, and have different commercial values. The impure residue left in the caldron is distilled separately, and yields rosin and pitch. The raw resin collected from the trees in the autumn is harder and less valuable than that obtained during the spring and summer.

We were told that, at the factory, 25 barrels (of 520 lbs.) of raw resin are distilled per diem in summer, and 16 in winter. The spirit of turpentine sells for 24s. per 100 lbs., and the colophany for 9s. per 100 lbs.; but the purer kinds, for the manufacture of which only the most liquid portions of the raw resin are put into the caldron, fetch from 13s. 6d. to 14s. 6d., the price of the finest quality, known as Venice turpentine, rising to £4, 10s. per 100 lbs. Comparatively small quantities only of the finer substances are extracted.

Utilisation of the Wood and Substances Extracted from the Pine Trees.

The effect of tapping the pine is to cause a flow of resin towards the lower portion of the stem, which thus becomes charged with that substance, and is rendered harder and more durable than the upper part of the tree. The resinous wood is used for various purposes: very largely for railway sleepers, when it is injected with creosote or sulphate of copper. We visited a factory at Labouheyre, in which the latter substance is used for injecting

sleepers and telegraph posts; and the superintendent assured us that, for pine wood, it is much superior to creosote. We saw many thousands of injected pine sleepers at this and other railway stations, and were informed that they are largely employed on the lines. Planks and scantlings, of which a large stock was lying at Labouheyre, are sent for sale to Paris; while poles, extracted during thinnings, are used as telegraph posts and mine-props. Last year, when we were in the Cevennes, we found that mine-props from the Landes were employed there. Charcoal is also made in some forests.

On our way from Labouheyre to St Eulalie, we visited an establishment for the manufacture of pinoleum, or pine-oil, which is used as a preservative for wood, and also, when prepared in a special manner, for burning in lamps, as a substitute for kerosine. The machinery was not working, and we were unable to study the details of the system; but the light given by the oil, which is made use of to a considerable extent in that part of the country, is very good, and it possesses the great advantage of not being explosive.

CHAPTER II.

FORESTS ON THE ADOUR, NEAR DAX.

The morning after our arrival at Dax, M. Delassasseyne, the Inspector, and M. Tellier, *Garde-Général*, took us to see some cork-oaks, which are grown, at a short distance from the town, like apple trees in an English orchard. *Quercus occidentalis* is almost identical in appearance with the cork trees we saw in Provence; but its fruit ripens in two years, instead of one, as is the case with *Q. suber*. The trees, which stand isolated from one another, and are much branched at about 7 ft. from the ground, are visited once in every eight to fourteen years, when the cork is removed from the entire stem; an average sized tree then yields about 22 square feet of cork sheets, which represent a net revenue of about tenpence a year. It is said that where *Q. occidentalis* occurs mixed with *Pinus pinaster*, it has here a tendency to drive the latter out of the field.

We spent the afternoon in inspecting the communal oak (*Q. pedunculata*) forests of Tilhieu, situated on the right bank of the Adour, a few miles above Dax; they are inundated, two or three times a year, to a depth of 12 or 14 ft., or even more. The part

of the forest that we entered first is of pure oak, forty years old, and about 50 ft. high; it is to be felled at the age of one hundred and twenty years. We remarked at once that the trees had an unhealthy appearance. They were much branched, and had crooked stems, covered with twigs (*branches gourmandes*) and lichen up to "high-water mark." Many of the larger branches were dead, while the stems were, in numerous instances, split by the action of frost; and it was evident that they required the protection of a lower stage of forest growth, which would remedy many of the existing defects. There were no seedlings on the ground, which was covered, in places, with ferns, brambles, a little gorse, and "butchers' broom" (*Ruscus aculeatus*). The forest is heavily grazed over by cows and bullocks, which, however, do comparatively little harm, because the inundations, which leave a deposit of fresh soil behind them, prevent the ground from becoming hardened by the animals' feet. M. Boppe remarked that natural regeneration is here very easy to obtain, for the oak gives seed every year, a plentiful crop occurring every second year; and the soil being extremely fertile, growth is rapid. But the old difficulty of treating a species of light cover as a pure forest has to be encountered; if the trees stand too thickly together, they grow up tall and thin, and many branches die; while, if heavy thinnings are made after considerable intervals of time, there is a large development of twigs on the stems. The treatment of such a forest is a very delicate operation, requiring much skill; and the only way to achieve success, is to make light thinnings frequently. If this be not done the forest will, in all probability, be ruined. If it were possible to introduce a mixture of hornbeam, which, unfortunately, does not succeed here, this tree would serve to protect both the ground and the stems of the oaks, without interfering with their crowns; and heavier thinnings, which would have a very favourable effect, could then be made among them. There are no kinds of harmful insects in this forest, probably owing to the periodical inundation of the ground.

Passing on, we traversed a younger portion of forest, where the oak is mixed with a few elms and maples (*Acer campestris*); and, leaving this, we entered a block, in which the final fellings had been made, from two to five years previously. Here the rapid growth of the young trees was very remarkable; those five years old having a height of 6 or 7 ft. The ground was densely covered, not only by young oaks, but also by a mass of tangled shrubs and

brambles, which spring up immediately after the final felling has been made; through these, the young oaks manage to force their way in two years, and they ultimately suppress them entirely. In this climate the oaks are not injured and checked by spring frosts, which occur so frequently, and do so much damage further north.

We now entered the oldest part of the forest, aged from one hundred and twenty to one hundred and fifty years, which has been subjected to uncontrolled selection fellings, and has, at the same time, been grazed over, chiefly by pigs and geese, which eat enormous quantities of acorns, as well as by other animals. Consequently, instead of finding trees of all ages on the ground, we saw a somewhat thin crop of old trees of great girth, which are branched and heavy topped without being tall, and are covered, in many instances, with climbing ferns, of, apparently, one of the species commonly found on the lower slopes of the north-western Himalaya. Under these large trees are seen dense thickets of bushes, between which the animals graze, and there are a few young oaks, of stunted and unhealthy appearance, which are not completely killed out by the cover, as they probably would be, under similar circumstances, in a more northerly latitude. For here the light is more intense, and they are, on this account, enabled to maintain themselves under cover of the larger trees; but they cannot grow up, so that they do little or nothing towards the establishment of a regular gradation of age-classes. In fact the selection method cannot be successfully applied in the case of a pure forest composed of species of light cover, even when there is no grazing; but when, as in this instance, animals are freely admitted, the system fails completely. If this portion of the forest were to be simply closed at the present time, a large increase in the number of stunted young oaks would undoubtedly follow, and some of these would push their way upwards in the more open places, but there would never be a properly constituted crop of sound and well-shaped trees of all ages on the ground.

But, fortunately, an effective remedy for this state of things can easily be applied. In order to get a complete crop of young seedlings, grazing must be entirely stopped, and the dense undergrowth of shrubs must be cleared. This latter process is found to act like a seed-felling, as it results in a marvellously dense growth of seedlings, which, a year or two after the bushes have been cut down, are sufficiently established to permit of the old crop being removed, and the forest is then completely regenerated.

We subsequently passed through parts of the forest where no grazing had been permitted for the last eight or ten years; but the bushes had not been cut away, neither had the old trees been removed. Here we saw a splendid crop of young seedlings in the more open places, and a quantity of suppressed growth among the bushes; all that was wanted was to complete the operation in the manner described. When this has been done, the seedlings and bush-coppice will grow up together; but, as has been previously mentioned, the oaks will soon push their way through the latter, and ultimately kill it out. There are here about 7500 acres of this sort of forest, all of which will, in due course, be subjected to the kind of treatment above indicated.

We returned home through a block which is heavily grazed over, but contains some magnificent old trees of the most picturesque appearance, the effect being equal to the most beautiful parts of Fontainebleau.

CHAPTER III.

TORRENTS NEAR BARRÈGES IN THE PYRENEES.

From Dax we travelled by rail to Pau, where we spent a few hours, and visited the splendid public gardens, which contain beech trees almost as tall as those at Villars-Cotterets. Thence we went by Tarbes and Lourdes, and on a branch line running up one of the valleys of the Pyrenees to the terminus, which is on one of the roads passing through the mountains into Spain. Some picturesque but dirty Spanish peasants, homeward bound, were among those who left the station with us at Pierrefitte, whence we drove to Barrèges.

The drive was lovely; the snow-capped granite peaks overlooking the stream which has cut its way into the Schist, and follows its narrow bed between almost perpendicular sides, often of great depth. Barrèges is at an altitude of 4200 ft., and is used as a sanatorium for soldiers, its baths having the reputation of being peculiarly efficacious in the healing of wounds.

After breakfast we started to inspect the torrent of Rioulet, on the left side of the valley. The hills are here, generally speaking, composed of firm strata, which are not liable to be washed down, and thus to cause disasters so serious as those which occur in the Southern Alps. But large avalanches are of frequent occur-

rence, and cause much loss of life and property. At a short distance above Barrèges our attention was called to a large mass of snow, which, during the month of April last, fell into the valley, and completely blocked it up. On the opposite side works are in progress with a view to clothe the hill-sides above the cultivation and villages, and thus to reduce the danger from avalanches.

We were now in a communal beech forest, which has a thin crop of old trees, with very good naturally-sown young growth on the ground; but there were many windfalls. We entered a nursery where young beech trees are raised for filling up places where the young crop is incomplete; and we then descended to inspect the large weir (*barrage*), which forms part of a system of works constructed in order to reduce the slope of the torrent bed.

On one side of the main valley the strata are exceptionally loose, and the water, cutting its way into them, causes the sides to fall in; thus, not only is an ever-increasing area of the hill-sides themselves ruined, but much damage is done lower down by the rush of water, and the deposit of silt carried down by it. This is an example on a small scale of what occurs, with such disastrous results, in the Southern Alps. The system adopted for the treatment of this evil may be briefly described as consisting of a series of obstacles erected in the bottom of the ravine, and behind which the rocks, gravel, and mud brought down by the water are retained. The slope of the bed being thus reduced, while, at the same time, it is raised, and consequently widened, by these deposits, the unstable sides receive support; and when they have been sufficiently consolidated, they are planted up. In this manner the forces of nature are directed and employed by man, to restore the damage they caused, when uncontrolled; much in the same way as they are in the treatment of the dunes, described a few pages back. The weir we inspected is constructed of masonry, and has a total height of 65 ft., including 20 ft. of foundations. It is one of those made when works of this nature were undertaken for the first time in 1862; and it was in the nature of an experiment. It is now seen that its design is faulty in many ways, and it cannot be taken as a model of what such constructions should be.[1]

[1] On a future occasion the writer hopes to give a more complete account of the works undertaken in the Southern Alps, which are much more extensive and interesting than those which were visited near Barrèges.

On ascending to a higher level, we looked across the main valley, and noticed that a good many torrents were in process of formation on the opposite side, a mile or so below Barrèges. The general appearance of the country led us to suppose that the bottom of the main valley was once filled by a glacial bed, through which the present stream has forced its way; and the secondary torrents, now cutting through the unstable sides, must be dealt with at once before they go too far. It is the intention of the Government to buy the land with this object. We next entered a plantation of *Pin à crochet* (*Pinus montana*, Miller) and *Pin noir* (*Pinus laricio*, Poir), planted in clumps. Many of these are dying off, and M. Luze, the Inspector, who accompanied us, feels considerable anxiety regarding their future. It seems probable that the trees, having got into an unhealthy condition, are attacked by a fungus, and, subsequently, by the insects, which we found in many of those we examined. With regard to the system of planting in clumps, it is said that the plants impede one another's growth, and that it is much better to put them in singly. These plantations extend up to an altitude of 7250 ft., larch being used above 6500. The plants are grown in temporary nurseries, which alone are suitable for mountainous regions, not only on account of the difficulty of carrying the plants over long distances, but also because the young seedlings should always be grown at the same level, and as nearly as possible under the same conditions as those in which they are to find themselves, when they have been put out. Before turning homewards, we had an excellent view of the snow-capped peaks, including the Pic du Midi de Bigorre (9440 ft.), which was close to us.

We returned home by the valley of the Pontif torrent, which is in a bad state, but has not yet been taken in hand. This gave us an excellent opportunity of studying the condition in which these torrents are found, before the works to regulate them have been undertaken.

Returning to Toulouse, next day we noticed that the lower spurs of the Pyrenees, which are well wooded, are, generally speaking, covered with a simple coppice of beech, cut in vertical strips. This tends to the formation of torrent beds, which indeed appeared to be commencing in many places. Thence we travelled direct to Nancy, where we arrived on the 6th of May.

REPORT OF THE SELECT COMMITTEE OF THE HOUSE OF COMMONS, 1886, ON FORESTRY.

In continuation of the investigations made on the subject in 1885, of which a Report appeared in last year's *Transactions*, a Select Committee of the House of Commons was again appointed on the 23d of March 1886, "*to consider whether, by the establishment of a Forest School, or otherwise, our Woodlands could be rendered more remunerative.*"

The Committee, which consisted of twenty-two members, met on the 19th of May for deliberation, and elected Sir John Kennaway, Chairman. The Committee met again on the 1st of June, when Colonel G. Pearson, and Dr J. Croumbie Brown, were examined at considerable length. At the next meeting, held on the 4th of June, Dr W. Schlich, Mr Julian Rogers, and Mr Alex. M'Kenzie were examined. The last meeting was held on the 18th of June, only five members attending, Sir John Lubbock in the Chair, when the following Report was agreed to :—

"*Your Committee have taken some evidence upon the matters referred to them, but have not had sufficient time to conclude their investigation on account of the Dissolution of the present Parliament; they have, therefore, agreed to report the Evidence already taken to the House, and to recommend that a Committee on the same subject should be appointed in the next Parliament.*"

It is much to be regretted that such an important investigation has been again interrupted, and that another season must pass over before any definite Report can be issued. The evidence tendered at the two meetings held by the Committee in June 1886, is of an interesting nature, and helps considerably in making the subject better understood.

The gist of the evidence, bearing on the establishment of a British School of Forestry and the advantages that may be derived therefrom, is contained in the following extracts from the Report of the Select Committee, which was ordered by the House of Commons to be printed, on the 18th of June 1886.

On Tuesday, 1st June 1886, the first witness called was Colonel George Pearson, who had given evidence in 1885, and in the course of further examination spoke as follows :—

"Have you seen any reason to modify the opinions you expressed before the Committee last year?" "None whatever. I am very

strongly impressed with the desirability of doing something to promote forest education in this country; or rather, to put it in the way of young men who may be desirous of obtaining it."—"You are just as strongly of opinion as ever that a forest school in this country would be desirable?" "Some forest education."—"And that not only from the point of view of our Colonial and National forests, but also with regard to woodlands in the hands of private owners?" "Yes; more especially with regard to the woodlands in the hands of private owners; the others are more or less satisfactorily provided for."

"When you were before the Committee last year your evidence was mainly of a general character; but you were good enough to say that if the Committee were re-appointed you would make some more or less definite suggestions as to the course which should be pursued; have you thought of any definite suggestions as to the course which should be pursued; have you thought of any definite suggestions to offer to the Committee?" "I have thought over the subject since, and I am prepared to suggest, not in detail but in a general way, what I think would be best adapted for the education of young men who would be likely to have charge of our forests; more especially private forests."

"Would you have the goodness to lay before the Committee the information you have prepared?" "The persons for whom a forest education in England is required may be divided into two classes: first, those intended for India and the Colonies; second, those who will seek employment at home. The education of the former is now, as far as I am aware, provided for in a satisfactory manner at Cooper's Hill, save in one essential particular, viz., the want of a tract of forest for practical training. For the second no education has as yet been provided. They are of two classes, viz.: firstly, land agents, being young men of good position and education managing one or more estates, including the woodlands on them, with salaries varying from £200 to £500 or £600 a year; secondly, wood-reeves, wood-bailiffs, woodmen, and foresters, with salaries varying from £80 to £120 a year. There is no field, however, in Great Britain (at present, at least) in which an educated forest officer, such as we find on the Continent, might gain a livelihood. The main object, then, seems to be to provide a certain amount of practical education in forestry to supplement the present generally very useful education given to the land agent class, and at the same time to teach the wood-bailiffs and foresters who are employed under their

orders in our own private woodlands, not only the elements of sylviculture, but also the best known methods of conducting ordinary forest work, such as planting, thinning, pruning, the management of coppice, and the best way of disposing of the crop; also, if possible, at the same time to provide a practical training station for the Cooper's Hill forest pupils. It seems to me that the essential point, to which all others are subordinate, turns on the possibility of obtaining a sufficiently large block of forest, say from 3000 to 4000 acres, half in leaf forest and half in conifers, in a convenient locality, as a practical training ground. This tract must be placed under a trained forest officer; and for reasons of economy it seems to me that he should be the Professor of Forestry at Cooper's Hill for the time being. Under him there must be a practical executive officer, with an ordinary woodman to do the work. If such a tract of forest could be obtained, say, in the Crown forests outside Windsor Park, the other details seem to me very easy. I should think that an arrangement might be made with the Professors of Forestry and Physiological Botany at Cooper's Hill to give, at certain convenient periods, lectures in those subjects of a simple, practical, and useful character. The executive officer in charge of the forest should teach the pupils all kinds of practical work on the ground, including the estimation of standing crops of timber, and the measurement of fallen trees; while occasional tours to see forest work in other places could be arranged for those who chose to follow them. In order that all societies and public bodies, interested in the good treatment of the land, should have an interest in the system of education, I think that the general direction and control should rest with a council or board, of which the Director of Kew Gardens might be *ex-officio* President, and the Forest Professors at Cooper's Hill members, and to which the Royal Agricultural Society, the Highland Society, the Surveyors' Institution, and similar bodies should send delegates, while two or three of the great owners of private woodlands should be requested to sit on the board. This board would be necessary to keep the teaching in touch with the requirements of the country; and it should control the course of study, arrange for the examinations, and granting of diplomas, and regulate the scale of fees. It must have a paid secretary for correspondence. I do not think that any great expense for buildings would be necessary. There would be wanted a lecture hall, with desks, etc., handy to the forest, and a few huts, perhaps, for the students, who might

wish to stop there; also, perhaps, two or three cottages for labourers and subordinates. But I do not anticipate any large outlay, as the bulk of the pupils would live elsewhere. I should assume the probable expenditure as follows:—Salary to lecturers, £500; resident lecturer and executive officer, including house rent, £350; wood bailiff, £100; paid secretary, £200; journeys and miscellaneous, £200. Total annually, £1350. I have not included anything for expenditure on the forest, as that should be paid for from the thinnings; as for museums and collections, those at Kew and Cooper's Hill should suffice for all. To meet this expenditure there would be the fees, not only of regular students, but it may be presumed of many wood-reeves and wood-bailiffs, whom their masters would be likely to send there for instruction. The deficit, if any, in early years may very well be supported by Government. But it must be clearly understood, that to be successful, such a tract of forest must be under the absolute control of the forest professor charged with it, who must be in fact its surveyor, and subject only to the financial control of the Treasury. As for the pupils, it is to be hoped that most of the young men who seek a land agent's career would gladly avail themselves of such a supplementary education with a view of augmenting their salaries in the future; that young men of a subordinate class, who seek employment as wood-bailiffs or wood-reeves, would do the same; and that many gentlemen who are possessors of more or less acreage of woodlands would gladly send for purposes of instruction the men who now manage their forests. It is certain that all these classes would derive enormous benefits from the establishment of such a forest school."

"At present the Professor of Forestry at Cooper's Hill has no control over any forests in this country, I believe?" "Absolutely none."—"And the Indian students go abroad for their practical instruction in forestry?" "It is intended that they should do so. I do not know that up to this time they have been anywhere; but I have nothing to do whatever with Cooper's Hill, or the training there, and I know nothing except from hearsay about it."—"But your impression of the intention is, that they should go abroad for their practical instruction?" "Yes."—"But you would rather that the Committee should get that information definitely from the authorities at Cooper's Hill?" "Yes."—"The training of a person who was to occupy the position of a forester would, of course, be carried further than that of a person who was to be

a wood-reeve or wood-bailiff; but in many respects it would also be the same?" "Up to a certain point it would be very much the same; but a person in the position of a land agent, who is to have the control and management of woodlands, ought to know much more, because he ought to know the effects of climate on species, so as to know what is suitable to plant in certain cases."—"Therefore there would be no difficulty in making the instruction which was intended for the higher grades very useful for the lower grades?" "They might be made to fit into each other. I expressed myself strongly about that, I remember, last year."

"How long do the studies last in the French Forest School?" "The training in the French Forest School extends over two years; only it must be remembered that it extends over other subjects than forestry; there are about 45 lectures in forestry, the same number in botany, half that number in geology, and half that number in mineralogy each year."—"How long do the Indian students remain at Nancy for that portion of their training?" "They have hitherto remained there three years, that is to say, two years and eight months exactly, viz., eight months as a preparatory course before they went into the school, and during the remaining two years they followed the same course as the French pupils. In the preparatory course the pupils went through, in a preliminary manner, with one of the professors, the general subjects of education, so as to put our students generally upon a level with the French pupils, and *au courant* with the subjects."—"In the case of wood-reeves and wood-bailiffs, how long would you propose to devote to their forest instruction?" "I should think from six weeks as the minimum to three months as the maximum, according to the amount of training that you might wish to give them, or that they might wish to have. A man of that sort could get all that it would be necessary for him to know in three months."—"You think that an owner of woodlands having an intelligent wood-reeve, if he sent him for three months to the school, would then find him fairly qualified to manage his woodlands?" "Yes, certainly, three months would be ample for a man who 'knew himself' in a forest to manage afterwards, because he would at once pick up things when shown the reason of them."

"Although our forests in England may not be quite so well adapted as those in France and Germany for the purpose of this instruction, you consider that there are woodlands which would serve the purpose?" "It would be distinctly necessary to bring

in a tract of forest into what we should call order, and it would take years to bring it into what we should call a proper state; but the very fact of doing that would be instructive of itself."—"No doubt, after that process had been gone through, the forests would be more suitable for instruction than they are at present; but I understand you say that even at present there are woodlands which would serve fairly well for purposes of instruction?" "I think any intelligent and educated forester would adapt his teaching to the place."

"Out of the £1350 which you have estimated as the probable cost of your forest school, a considerable amount, no doubt, would come back in the shape of fees; do you think it would be possible to form any estimate at present of what the net expense might be?" "It is very difficult to do so. I have talked the subject over with Mr Rogers, of the Surveyors' Institution, and he thought that we might soon calculate upon 50 pupils."—"That would be 50 pupils of the higher class?" "Yes."—"Therefore the expense probably would not be any considerable proportion of the £1350, and possibly after a time it would be self-supporting?" "We thought we might charge them £20 for the course; if so, that would provide for £1000, and then you would pick up whatever you charged the wood-reeves. If their masters paid for them, no doubt you might charge them an appreciable sum; but upon the young men themselves, who hoped to get employment afterwards, you would have to put a low fee. I am not very well acquainted with the sums paid for education by those classes, but I think generally you could very soon either cover or nearly cover the sum."—"Then there would probably be some young men who would go to the school with the view to obtaining employment in the Colonies afterwards?" "Yes; but I suppose men who would hope to get appointments in the Colonies would hardly get a sufficient amount of training here. The Colonies would look for young men who had spent more upon their education, who had been sent to Cooper's Hill, and gone through a perfect course there."—"The young men who would be qualified for the Indian forest service would clearly be qualified for the Colonial forest service?" "Certainly; for one or two who have failed to get appointments for India I have obtained appointments in the Colonies, and the Colonies have gladly accepted them."—"Is there any point which you would like to add to your evidence?" "I think that embraces pretty well all that I have to say."

"Is Cooper's Hill purely a place for theoretical instruction?" "Up

to the present time it has been entirely so; but I have only been to Cooper's Hill one day since a forest school has been established there, and, except that I know personally the people connected with it, I have no information about what they do at Cooper's Hill."—"It is not like the Royal Agricultural College at Cirencester, where they have practical and theoretical instruction combined; there is no forest in connection with Cooper's Hill to which the students can be taken?" "No; that is precisely what I wished to convey by my evidence. To my mind the instruction now given at Cooper's Hill will be thrown away unless a tract of forest is provided handy to which pupils can go. I do not see how it can be carried on without it."—"As matters stand, by the time the pupil gets into actual practical contact with forestry, he has probably forgotten all about the theoretical instruction?" "Yes. The only way to convey instruction is, after having been in the lecture-room, to take the pupils on to the ground and point out the facts. Unless you do that they do not believe it; that is done most carefully in the Nancy College."—"Then our pupils are compelled to go to Nancy for, what we call in medicine, clinical instruction; but the conditions of forestry in France are very different from what they are here in respect to climate and trees?" "No; I do not think there is much difference in France from what there is here. I sent Broillard's book on forestry to one of my brothers, who possesses some woodlands, who wrote to me: 'I am very much surprised to find that I have the same condition of things here as M. Broillard's book indicates; one would not have thought it possible that the conditions were so much the same upon both sides of the Channel.' If you went to the Alps the conditions would be different, of course, but not upon the level in the centre of France."—"Have you calculated what would be the expense to a forester if you sent him up to study?" "It would cost him from 10s. to 12s. a week to lodge and board in some country inn, and if you added whatever the fee was, say from £5 to £10, and the journeys, that would be about the expense."

"From the evidence you gave last year, you did not recommend that a Scottish forester should be sent up to Cooper's Hill?" "No; I should hope that the Scots would establish a similar school in Edinburgh, which would be in the same relation to their own people. It is better not to think of too many things at once; if you could establish one as a model, the others would be able to work upon it. I should never think the Scots would send their pupils to Cooper's Hill; but if you could once start the thing here, I have no doubt a

similar school would be arranged in Edinburgh."—"You think that would be suited for practical work?" "Certainly, I think the instruction would be practical; and if you had your lecture-room contiguous to the forest you could give both descriptions of instruction; but you must have the forest handy."—"But suppose you had your lectures in Edinburgh, where could you take your young men to?" "That would be the difficulty, unless any of the large landowners near Edinburgh would give up a forest to be managed in that way, as has been done by the great landowners in Bohemia, where the conditions are very much analogous."

"You think it is essential to a school of forestry to have attached to it a reserve forest as a school of study?" "It is absolutely necessary. I think a mere teaching school is entirely useless. I do not think that the young men who would go there would believe in it; the theoretical instruction goes in at one ear and out at the other when unaccompanied by any practical illustration."—"In France is there any difficulty in obtaining such reserve forests?" "No; because the bulk of the forests belong to the Government. The Nancy school has a great part of the forest above Nancy, two divisions of it, absolutely at its disposal, with some oak forests ten or twelve miles off."—"In France is there any obligation upon the owners of woods and forests to place their woods at the disposal of the schools of forestry for the purpose of instruction?" "No, except by courtesy. We have frequently been into private forests, but always by the courtesy of the owner."

"I think you have said that any establishment at Cooper's Hill would not meet the wants of Scotland?" "It is too far off."—"And you hinted at the establishment of a similar forestry school somewhere in the neighbourhood of Edinburgh?" "Yes."—"An essential necessity for that would be a reserve forest of some 3000 or 4000 acres. You have made yourself acquainted with the management of some of the large forests in Scotland—Lord Seafield's you have mentioned, and Lord Lovat's—am I to understand that they are too far distant from your headquarters, supposing they were at Edinburgh, or are Lord Mansfield's, or the Duke of Athole's, sufficiently accessible to answer your purpose?" "They are any of them sufficiently accessible; they are quite sufficiently near to be utilised. The only convenience of having a forest belonging to the school is, I think, that no forest is really capable of being properly used for instruction unless it is under the command of the forest officer; he must be able to transform it in any way he likes. The difficulty in respect to a Scottish forest school seems to be, that

it would require a larger expenditure to get possession of a tract of forest in which forestry might be taught."—"Assuming that were arranged within a distance of 150 miles, that distance is not, in your judgment, too far for the purpose of imparting instruction?" "No. In France we went to the forests everywhere. We put up in the village inns; it was no great expenditure, and I do not know why you should not do it elsewhere. Except in the forest of Nancy, where the pupils were taken in every day for ordinary operations, the other teaching was given round about; sometimes we went to St Gobain, Villars Coteret, and into the Jura. We travelled third-class, and stopped at the village inns, and there was very little expenditure over our excursions. But it is necessary also to have a tract of contiguous forest for daily teaching."

"With reference to the reproduction of larches in Scotland, you stated in your evidence last year that the best reproduction you had ever seen was in the neighbourhood of Milton Castle; can you tell us where that is?" "If you are looking from the Spey up to Milton Castle, it would be in the woods to your right front."—"Is Milton Castle the correct name?" "No, they are the Milton Woods; it was not very far from Grantown, near Lord Seafield's residence."—"That was a north slope?" "Yes."

"Have you given your attention since last year to what you would consider the best school for sylviculture in England; last year you had not made up your mind?" "I think the best plan would be to get a forest as near as possible to Cooper's Hill, where there is now an educated forest officer, and put the forest under his charge with an executive officer under him."—"Is there a sufficient amount of woodland close to Cooper's Hill?" "Yes, there are about 15,000 acres outside Windsor Park, from which I think a selection might be made."—"Would you afford facilities for the visits of pupils to our larger forests for special instruction?" "I think they would get there what was required for daily instruction, in fact, for the exemplification of the lectures."—"And what would you estimate to be the amount of forest or woodland which it would be desirable to attach to a forest school?" "I think 3000 or 4000 acres would be sufficient, half in leaf forest and half in conifers. At Nancy they have 1600 hectares attached to the school; that would be nearly 4000 acres. There are two divisions of the forest, about 800 hectares in each. A hectare is two and a half acres. That is what they have considered necessary for the exemplification of the lectures."—"But in the immediate contiguity of the college, from 3000 to 4000 acres would be

sufficient for the exemplification of the lectures?" "Yes."—"That could be procured at Cooper's Hill, could it not?" "Yes, subject to the approval of the Crown, because they are Crown forests. I only make the suggestion. I have no idea whatever whether the Crown would be willing to place that forest at the disposal of the forest school; but I suggest that if it were possible to obtain 3000 or 4000 acres of the forest which lie outside Windsor Park, the practical teaching of the lectures would be sufficiently provided for."—"For that reason you would prefer Cooper's Hill to the Royal Agricultural College at Cirencester, as suggested by Mr Biddulph?" "Simply for this reason, that you have the Cooper's Hill professor, whose business it is to be there; and I should think that for a reasonable remuneration you might obtain his services; and he, on the other hand, would be glad to have a forest to which he could take his pupils."

"You think that the science of the question bearing upon the larch disease would be well brought out in a school of forestry?" "I think it would be one of the most useful things."—"And then you think that our foresters, who are not generally highly-educated men, would learn sufficient scientific knowledge to enable them to put it practically to a good effect in smaller woodlands, distinguishing woodlands from the larger area of a forest?" "I should only give the foresters a very moderate amount of what I should call scientific training. I should only teach them the A B C of the conditions under which trees grow, and then I should take them to the forest and show them the way the trees grow; that would be an enormous advantage. If you take our forest men, you will see that in numberless cases they cut off the arms of trees, leaving long snags, which everybody ought to know is about the worst thing that can be done, because a hollow forms where water lodges, which works to the trunk, and tends to the decay of the tree. But if you talk to nine woodmen out of ten in this country, they will argue that they have always done that, and that it is the right thing; whereas the experience they have had ought to have shown them to the contrary."—"The arms ought to be cut off flat?" "They ought to be cut off flush. We have at the school at Nancy a complete set of specimens, showing the effect of the different ways of amputating the arms of trees; five minutes' glance at that would show you the truth of what I have stated. These were sections cut out of trees, showing where the snags had been left in, where they had been cut shorter, and where they had been cut straight, and the

growth of the wood over the wound. There are fifty or sixty different specimens showing this, and a quarter of an hour's instruction to the pupils would convince every one of them at once, if they were at the same time shown the specimens."—"Were those drawings, or the actual woods themselves?" "They were pieces cut out of the trees, and were shown at the Paris Exhibition. Nothing could be better than that, because five minutes' inspection and explanation to an intelligent man would show the different effects of having left the branch with a long snag, and of paring it quite close to the trunk."—"In regard to Cooper's Hill being the centre of the School of Forestry, have you any proposition to make with regard to the establishing of an affiliated branch—let us say, of such a school in Scotland?" "I would rather not say anything about that, because I have not been in Edinburgh lately, and I could not speak from personal knowledge. But I think that the Scots must take it up, because it is naturally too far to bring Scotsmen of the forester class to Cooper's Hill. But, as I have said all along, you cannot have proper forest teaching unless you have a forest under your control to which you can send your people; and it would not be sufficient to have permission from the Duke of Buccleuch, or any other large wood-owner, to go into his woods, because his manager would say, 'No, I have my own ways of managing, and I cannot have you interfering.'"

"You have expressed, on the whole, a favourable opinion of the state of forestry in Scotland as contrasted with that in England. In M. Boppe's Appendix to the Report on the English and Scottish Forests, on page 47, he says: 'We were also struck by the monotonous regularity in the height and age of the trees, unmistakable sign of their artificial origin and want of methodical management. The forest, here left to its own devices, continues growing just as the hand of man has planted it; the undergrowth is constantly grazed down by the sheep and cattle; and Nature, in spite of the immense resources at her disposal, is quite powerless to modify the work of the planter, or repair the errors committed by woodcutters.'"—"In that passage he seems to imply that, although the Scottish forests may be superior to the English, there is great room for improvement?" "What he desired was to see the system of natural reproduction introduced much more largely into the Scottish forests, considering that that would be the means of avoiding disease in the larch, and that, as Scots fir reproduces itself so very readily, it would be a great saving in the expense as compared with

planting."—"M. Boppe appears to imply that, in his judgment, the beech might advantageously be cultivated more in Scotland than has been the case—that it has been somewhat neglected?" "In all my conversation with Scottish and other foresters in this country, their objection to the beech is that they have no market for it. In Buckinghamshire I have been to see the indigenous forests there; but there is a large manufacture of chairs carried on there. In foreign countries there are a number of little things which are made out of beech, which nobody thinks of employing in this country. It is very difficult to get rid of beech. We do not use wood for firing, which is one large use of it in France."—"When you say beech is difficult to get rid off, you mean difficult to sell?" "Yes. In France it is one of the most valuable trees; in Germany, since the introduction of coal and railways, it is one of the great problems how to sell the beech, which has been always used for firewood."—"What M. Boppe means, if I understand his report rightly, is, that if you are growing oak or other trees, they would do very much better if you mixed them with a certain quantity of beech?" "By 'cultural reasons' he means that it is so valuable for mixing with other trees, in order to get satisfactory results. He thought, and I think, certainly, that larch, if it were mixed with beech, would not be attacked with disease. We all know that the beech is the best tree you can use to mix with the oak, for example."—"Does not M. Boppe wish to imply in this sentence that it would be of advantage to the Scottish forests if beech were more largely used?" "Undoubtedly."

"M. Boppe suggests that sheep might be advantageously kept out for the first forty years and the last twenty years, but that they might be admitted during the intermediate period of sixty years, and that the pasturage in that case would be very good: did he not intend to imply that, in his judgment, the Scottish foresters scarcely adopted what he considered to be the best rule with regard to the admission of sheep into forest lands?" "Certainly; it is a very important thing. If you allow that the life of a forest is a hundred and twenty years, you would have better grazing during sixty years of it if you kept them out during the first forty years and the last twenty years; it would rest the land."—"Then M. Boppe says: 'It would certainly not be fair to hold the Scottish foresters responsible for the present regrettable state of affairs; for, though they have for the most part admitted the inefficiency of the present system, they are powerless to effect any improvement so long as the landowners and general public

have not learnt to appreciate the manifold advantages to be derived from a regular and methodical management.'"—"That passage, again, appears to imply that, in his judgment, the Scottish management of woodlands might be very considerably improved?" "I think in that case he was thinking of the shooting, because I remember Mr Dewar saying, in Lord Lovat's forests, that he was prevented from going into the forest for seven months in the year, and that in the months he most wanted to be there; that he could only go into the forest for five months in the year, because it was the condition of the lease of the forests that he should not go into the forests while the red deer does were there. It was a question not of the forests, but because the contiguous mountains were leased for deer forests." —"Then in that particular case you think he was merely regretting that the forests were sacrificed to the shooting?" "I am quite sure of that."—"Further on he says: 'It is, therefore, a matter of regret that among all the forests visited by us in our travels, there is not a single one suitable for the teaching of sylviculture.'"—"There, again, he implies that, in his judgment, the Scottish woodlands might be much better managed than they are?" "Undoubtedly; but he rather alludes to the teaching in that paragraph."—"But if a forest had been well managed it would be adapted for sylviculture?" "Yes."—"He also was of opinion that there are very large tracts in Scotland which, properly dealt with, might be planted with advantage?" "Yes, that is his opinion."—"So that, while finding much to admire in the Scottish management, he also thought there was much room for improvement?" "I think he was of opinion that they knew how to get profit out of their forests very well; but that they did not cultivate them so that they might produce the greatest profit; that they rather sacrificed future profit to the present; but that will perhaps always be the case with private forests, more or less."—"At any rate his opinion was that, however well they might be managed, there were many points in which the management might be improved under a better system?" "Yes, he thought that instruction was much wanted by the bulk of the wood managers."

"Supposing that the Professor of Forestry at Cirencester was in charge of a certain amount of forest land, would that, in your judgment, be as good an arrangement as having a Government school?" "I went to Cirencester by the desire of the India Office to see what I thought about it as regards forest teaching. The principal reason why I thought it would not do was that, although there are

beech woods or forests, there is no fir forest very handy to it, and the education at Cirencester is a rather expensive education; it would be difficult to dovetail the forest instruction with it. Still, I think that at Cirencester it would be a very good thing to have a professor of forestry for the teaching of their own pupils."—"Then your preference is not for the teaching of a Government school *per se;* but you do not see that in the case of Cirencester it would be easy to adapt their arrangements to the needs of a forestry school?" "That is so."—"Your reason for thinking that it would be necessary to have a separate school for Scotland is on account of the distance?" "Yes, quite so."

"With reference to the expense of Cirencester, I think one of your objections to Cooper's Hill last year was the great expense of attending there, and that you thought that on account of the expense Cooper's Hill would hardly provide a school, which was very essential, namely, one for wood-reeves and wood-bailiffs?" "The arrangement I contemplated in my memorandum was only to have the instruction near Cooper's Hill for them, but in no way connected with it, except so far as that the professor would have the charge of the forest and also of the education, and that practical education should be given by the officer in charge of the forest, but subordinate to the professor. I would not advocate the sending of the forest pupils to Cooper's Hill for any other instruction."—"But that education would be quite distinct from the education given at Cooper's Hill, which is given to engineers?" "Certainly. The only thing is, that there being a professor of forestry already there, by giving him a few hundreds a year extra, you ought to be able to secure his services for giving instruction to other people."—"Supposing that the woods could be got and placed under the control of the professor of a forest school, would not a forest school at Cirencester be more appropriate, that being an agricultural college, than to attach it to a college which is intended primarily for engineering?" "But you have not got a forestry professor at Cirencester."—"But you suggested just now that you might have a forestry professor at Cirencester?" "But it is a long way from London, and therefore I look upon it that the bulk of these land agents, though there are some of them at Cirencester, yet the bulk of them get their education in London; and I think there is a great advantage in having your school as near the metropolis as you can."

"You stated just now, with regard to the School of Forestry in Scotland, that you did not consider a distance of 120 miles too far

off for the purpose of teaching forestry, in connection with the school at Edinburgh?" "But I also contemplated that they would get into the Duke of Buccleuch's, or some of these woods round about Edinburgh, for the purpose of daily education."—"You would be aware that the Forest of Dean is very accessible from the Cirencester College?" "It is so, I believe."—"It is only a few miles by rail?" "But I prefer Cooper's Hill. I think you would get more pupils at Cooper's Hill than you would at Cirencester."

"You came here more especially to give the Committee information as regards the establishment of a School of Forestry; and I do not think we have had information exactly before us as to how long the School of Forestry has gone on at Cooper's Hill?" "I think the Professor went there last September; it is only just commenced; the pupils are doing their last year at Nancy now."—"Then we must go further back, and ask you what steps the Indian Government took to have men educated for forest purposes?" "I suppose it was in 1864 when pupils were first sent to Nancy. Dr Brandis organised a system of instruction upon the Continent, sending half the pupils to Germany, to Minden I think, one of the German forest schools, and the other half to Nancy."—"Was that under the orders of the Indian Government?" "Yes."—"They entrusted him with the carrying out of the plans?" "Yes, they entrusted him with the duty of organising a system of education. When I came home at the end of 1872 the pupils had got idle, and there was not much work being done. They were getting out of hand; and very soon after I came home at the end of 1872, the Indian Government sent me to Nancy, to look after the pupils and superintend their education, and they transferred all the pupils very shortly afterwards from Germany to Nancy; so they were all immediately under my control, and there I remained eleven years."—"How many pupils had you under your charge?" "At first I had not more than three a year; but they increased very shortly afterwards, when six, seven, and eight were sent to me each year; and of late years I had as many as twenty going through the three years' course."—"Did they go free?" "At first the Government used to give them £50 a year to pay for their education; lately they had to pay 3500 francs, which they paid entirely themselves."—"Are you speaking of the English or the French?" "Of both; the French had to pay for instruction there."—"They were admitted by competition?" "Yes, and the English people were admitted by competition, and after their examination (they generally had an examination

in January) they were sent to me at Nancy about the 1st of March, and from the 1st of March to November they were going through a sort of probationary course under one of the professors, who took them into the forest; they learnt French, and they got into the way of following the lectures. At the end of two years they passed out by a final examination, for which a certain standard was exacted."—"They paid how much each?" "The English pupils paid £144 a year and the French paid £120 a year, which went entirely for their maintenance in the school, because they paid nothing for their education. The professors were paid by the Government."—"The men going in for this education have to pay at Nancy about £130 a year for two years?" "For two and a half years; we used to calculate the whole expense incurred as somewhere about £500, including journeys and the expense of the previous education."—"The French were also admitted by competition?" "Yes, the French were also admitted by competition."—"Would they also have to pay a sum of £500?" "It was rather less for the French, because they were lodged in the school, and the school buildings were the property of the Government; they got in minus their lodging, but it was pretty expensive for them, because they were charged for their uniforms and for the furniture of their rooms, and there were great complaints about it."—"Is the Nancy school self-supporting?" "There are two establishments in France, one at Les Barres for subordinates, while the Nancy school is for the superior grade. The Government grant was about 150,000 francs, or from £5000 to £6000 annually for forest education, but it did not appear from the accounts how much of the grant went to each school; sometimes the Government favoured one and sometimes another; the professors were paid, and the school buildings kept out of the grant."

"Have the Indian Government ever made a suggestion to meet this difficulty of the want of a practical training station for their pupils?" "Since I left the Government service two years ago, I have not been consulted by the India Office at all; I know nothing except what I have heard from my friends."—"Do you believe that they have considered it?" "It is absolutely necessary they should do it; but the present plan is that they should go abroad into the French or German forests for the practical study."—"Do you think that the Indian Government might be expected to contribute towards the establishment of a practical training station?" "If they benefit by it, I do not see why they should not contribute."—"You suggested

Windsor Forest as the most practicable station for learning forestry; would there be in the area that might be allotted for that purpose varying conditions of climate, aspect, and altitude, sufficient to make it a good practical training forest?" "You would have to supplement it, undoubtedly; but what is absolutely necessary for the purpose of practical explanation would probably be found there. I do not see how you can get on without something of the sort."—"And you think it might be found for practical purposes in the Windsor Forest?" "I believe in the forests round about there it might be found."—"And, although 130 miles is possible to be reached from the school, it would be far better to have something you could see in the course of an afternoon's walk?" "It would be absolutely necessary that the pupils should be able to go into some woods within an easy walk."—"With regard to this very interesting tour of M. Boppe in Scotland, have you any idea how the expenses of that were met?" "The Indian Government paid for everything; we were met everywhere by carriages, and we were sent about very well indeed."—"There was nothing to show in the Paper that was handed in that it was entirely organised by the Indian Government?" "It was certainly organised by the Indian Government entirely. I was desired to go with M. Boppe."

The next witness called was the Rev. JOHN CROUMBIE BROWN, LL.D., of Haddington, N.B., the well-known author of several treatises on the education of Foresters, and of works on various important branches of Forestry. In giving his evidence, which throughout bore directly on the subject, he stated as follows:—

"You have kindly come here to give the Committee your idea of how or under what conditions a School of Forestry might be established?" "Yes. The particular point upon which I can supply information to the Committee is this: I know a good deal of the waste that is going on in our colonies. I have made myself acquainted with the most advanced forest economy of the day; and I am also acquainted with most of the schools of forestry upon the Continent; I have visited several, and I am prepared to state how I consider Scotsmen can be most efficiently, and at the least expense, trained up so as to manage our colonial forests advantageously. That is the particular point to which I have given attention."—"But the Committee are principally interested in our home forests?" "I am aware of that; but the point upon which I can give information principally is with reference to colonial

forests, which are a large part of the British possessions, as much as India is, upon which much evidence has been already given."—"The Committee looked forward with great interest to hear your evidence upon this subject; but we ought to try and confine ourselves as much as possible first, perhaps, to the necessity of such a school in view of the waste that is being committed daily; and, secondly, as to what practical steps should be, and are possible to be taken to make up for that waste, and to raise up a class of men who will enable us to deal with our forests better than they have been dealt with hitherto?" "I will endeavour to give my evidence upon that aspect of the case."

"You have had a great deal of experience in South Africa with regard to the forests there, have you not?" "Yes; I know the waste which has been going on, and the consequences which have followed that waste."—"When the Cape authorities were in want of a forest officer they had to obtain the services of a French gentleman?" "They got a French gentleman to look after their forests, who, when he went to the colony, could not, it is said, speak a word of English."—"Naturally they would have preferred to have appointed an Englishman if they could have found one competent?" "Decidedly; but there was not such an Englishman to be found."—"And that would be the case at the present moment?" "It would be the case at the present moment, excepting that there are officials from India who have returned to this country, who might be disposed to go to the Cape as being a healthy settlement; but there is not, so far as I know, an English forester capable of taking the management of the Colonial forests."—"And there are only a very few Indian officials who are at any time available?" "Apparently."—"And these the Government would be sorry to lose?" "I have no doubt of it."—"So that there is great need for trained foresters in this country?" "Very great need."—"You are of opinion that the management of our forests and woodlands would be much more successfully carried on if there were properly trained foresters to do the work?" "I am satisfied that they would be, but simply upon this ground: according to the advanced forestry science of the day, there is no hard and fast rule laid down for the management of any forest; but the students in the various schools upon the Continent are thoroughly instructed in all that pertains to the healthful growth of trees, and then they make their own application of the science to the circumstances in which they may be called to act."—"In fact, the establishment of a forest school would,

in your judgment, be a great advantage, not only to the colonies of which you were speaking just now, but also to the mother country?" "Very great."—"You think that a scientific education and a regular course of training on the part of those who have the management of them would very much improve the condition of our woodlands?" "Very much."

"Do you consider it would be necessary to have a tract of woodland closely contiguous to such a school?" "Not at all."—"But you would be of opinion that it would be necessary to have control of a tract of woodland, although it need not necessarily be immediately on the spot or contiguous?" "I may state my opinion, and that is the opinion of the majority of the forest officials, forest administrators, and professors of forest science on the Continent."—"That the management of this particular tract of forest should be under the control of those who were charged with the instruction in the forest school; is that so?" "No, not at all. The question has come up on the Continent in this form: a conference of German foresters, forest administrators, and professors of forest science was held, when the question was discussed: Is it desirable to have schools of forestry as separate and special institutions, or to have them connected with the higher schools and universities of the Continent. It was only incidentally that the question of forests came up in that connection. There were only three or four in favour of maintaining the old special schools in connection with the forests; the rest, to a man, were opposed to it."—"Then you do not think it necessary that the management of the woodlands in which the instruction is given should be under the control of those who give that instruction?" "Although it is not necessary that it should be under the control of those communicating the instruction, it is desirable that there should be forests to which the students along with the professor may have access. They may be in the neighbourhood of the school; if in the neighbourhood so much the better; but they may be 100 miles off, or they may be 200 miles off. It is desirable that they should have forests to which they have access, but it is not necessary that those should be under the control or direction of those communicating the instruction."—"Supposing, for instance, the Cirencester College were to take up forest instruction if it had access to the Forest of Dean, that you think would be sufficient for the purpose?" "The principle would lead me to say so. I do not know the details of the Cirencester College, and therefore I cannot commit myself beyond that; but the principle involved would lead me to say so."

"What do you think would be the most suitable situation for a forest school?" "Edinburgh."—"Do you think it would be desirable to have one forest school for England and Scotland, or do you think that the conditions of Scotland are so different that it would be desirable to have two?" "My belief is that such tuition might be followed in Edinburgh as to fit English foresters for the management of English forests; but if, from national feeling or from disposition, it is considered better to have such a school as Cooper's Hill, which is founded upon a very different model from that of our Scottish educational institutions, by all means let us have it; but my opinion is, that we could do all that is required perfectly well in Scotland."—"You think that one forest school would be sufficient?" "One would be quite sufficient, and there is an advantage in having one thoroughly equipped and thoroughly efficiently conducted institution."—"How far do you think a forest school for the use of Great Britain should be formed upon the model of the modern Continental schools?" "I am acquainted with every school upon the Continent, and have visited several. There are many upon the type of which a British school might be formed; there is no one to which, as a type, the British school should be conformed, much less any one which would serve as a model."—"Which of their forest schools, upon the whole, do you think would be the one most nearly adapted to our requirements?" "If in Edinburgh, I should think the school in Spain."—"If the school were established in Edinburgh what arrangements do you suggest should be made with regard to it?" "It depends very much upon the form that it may take. If it were a private enterprise, managed by the *Scottish Arboricultural Society* or the Highland and Agricultural Society, one form; if it were connected with the Watt Institute, another; if connected with the University, a third; if connected with the Museum of Science and Art under the Committee of Council on Education, a fourth."—"Which, upon the whole, do you think would be the best?" "I have a very strong conviction that, upon the whole, it is best that it should be connected with the Science and Art Department of the Committee of Council on Education, if it were founded upon some such model as the School of Mines in London, or the School of Science in Dublin."—"You think, then, it would be better that it should be a Government school rather than be left in any way to private enterprise?" "It would be very much better that it should be a Government school."

"Would you be prepared to give the Committee a rather more definite sketch as to how you would propose to arrange the system?" "One great advantage of its being in connection with the Committee of Council on Education is this: it is desirable to have young Scottish foresters thoroughly educated. They are fitted by heredity and by early training for giving themselves entirely to forest work; it is, therefore, desirable that they should be specially trained. In connection with the School of Mines in London and the School of Science in Dublin there is ample provision made for the support of any of the students who require support, and yet it is not given as a dole, or as an alms, but as the result of competitive examination and merit."—"Did you hear the evidence given by Colonel Pearson as to the staff he would think desirable for a forest school?" "I did."—"Do you concur with that evidence?" "No. He speaks of Cooper's Hill College; I speak of a school in very different circumstances. The idea of having it in connection with the Committee of Council on Education rather than with the University is, that there is a possibility of a gradual development in the former case, whereas if it were in connection with the University you would be tied to one professor. Now it seems to the student of forest science as ridiculous to speak of one professor of forestry as to speak of one professor of medicine or of one professor of theology. If it were in connection with the School of Science there might be one individual, such as Colonel Pearson referred to, at first taking the whole management; and there might be, at comparatively little expense, specialists obtained from the Continent to take particular branches of study for three weeks, or six weeks, or three months at a time, until it was seen from the results produced that it would be desirable to incur increased expenditure in getting a larger staff of officers and instructors."

"Have you prepared a detailed curriculum which you would suggest; a three years' course of study?" "I have. My suggestions are as follows:—

"First Year.—*Winter Session.*—Instruction to be given in the structure and physiology of trees and shrubs, and in the geographical distribution of forests; in the treatment of forests by Sartage, by Jardinage, by *à tire et aire*, by *les compartments*, or the *Fachwerke Methode* of Germany; in the application of this to coppice wood, with a view to securing, along with other advantages, a sustained production of wood; and in the application of it to timber forests, according as the object may be to secure from these a maximum

size of timber, or a maximum produce of wood, or a maximum pecuniary return, along with natural reproduction, sustained production, and progressive improvement of the woods; and in measures to be employed in the conversion of coppice wood into timber forest, of timber forest into coppice wood, of mixed woods into either, and of either into mixed woods. With attendance on the classes in the University for the study of natural history, of mathematics, and of engineering; or, with attendance on the classes in the Watt Institution and School of Arts for the study of mechanical philosophy and of mathematics.

"*Summer Session.*—Attendance on the classes in the University for the study of botany and vegetable histology, and of practical natural history, and of practical engineering; or attendance on classes, if open, in the Watt Institution for the study of botany, and of mechanical and geometrical drawing.

"*Autumn Months.*—Tours of observation, with or without the teacher, in woods and forests in Britain, in France, in Germany, or in the north of Europe.

"SECOND YEAR.—*Winter Session.*—Instruction in regard to forest economy, forest legislation, and forest literature in Britain; in France and in Germany, countries in advance of all others in forest science, and in the practical application of it to the management of forests; in Russia, where arrangements are being made to introduce and to carry out extensively the improved forest management practised in Germany and in France; in Finland, where arrangements have been made to manage the forests in accordance with the requirements of forest science; in Sweden, where the latest arrangements suggested by forest science are being carried out with vigour; in British colonies; in America, and in India, where have been introduced many of the suggestions of modern forest science, and the forest economy practised on the Continent of Europe. With the attendance of the classes in the University for the study of theoretic chemistry and practical chemistry, natural philosophy, and the practical application of the same; or with attendance at the classes in the Watt Institution and School of Arts for the study of chemistry and practical chemistry, of engineering, and of geology.

"*Summer Session* and *Autumn Months.*—Practical experience in the management of woods, or in the management of nurseries, to be acquired under the direction of approved foresters or approved nurserymen.

"THIRD YEAR.—*Winter Session* only.—Instruction in the chem-

istry of vegetation and of soils; in the meteorological effects of forests on moisture, on temperature, and on constituents of the atmosphere; in sylviculture, as applied in Belgium, etc., to utilise waste lands; in the lands of France, to arrest and utilise drift sands; in the Alps, the Cévennes, and the Pyrenees, to prevent the disastrous effects and consequences of torrents; on the Karst, in Illyria, to restore fertility to land rendered sterile by the destruction of trees; in the United States of America, to prevent anticipated evils; in India, to secure desiderated good; in Britain, to increase amenity, covert, and shelter; and instruction in the injurious effects of cattle, insects, and various diseases on trees. With attendance on the classes in the University for the study of geology, of agriculture, and, if it be desired, any of the following: for the study of political economy, of conveyancing, or of bandaging and surgical appliances; or with attendance on the classes in the Watt Institution for the study of animal physiology, of German, or of French. I may add that in connection with the above studies I would advise that a course of instruction should be given in forest botany, in forest mycology, or the study of fungi, in forest entomology, in forest ornithology, and in forest masology."

"Would you suggest that in such a school, if established, there should be any opportunity for research as to the different circumstances affecting forest products?" "I consider that it would be exceedingly desirable. There are now established at the seats of several of the schools of forestry upon the Continent stations for research; they are not connected with the school, they are supported by the Government, but placed at the seat of the school in order that the students may have the benefit of the professor there; and in some of the schools I have referred to, as in that in Spain, where they have failed to secure such an experimental station, very great advantage has resulted from the students being encouraged by the professor to engage in research upon a smaller scale."—"Would you propose that such a school should likewise make any experiments with regard to the suitability of particular soils, exposure, the combination or association of different trees one with another, and other similar problems?" "There are no objections to their doing so. These stations for research to which I have referred have an international connection; when one is formed they communicate with the others, and state the particular department to which they intend to give their attention, and they leave the rest to the others, so that no two of them shall be occupying the same

field of research."—"So that, although that might not be the primary object of the school, you think it would be a very considerable advantage?" "Certainly."

"This elaborate course of study that you suggest is, presumably, only for those foresters who are to be employed abroad in public work?" "My view is that the students should be trained as students, and, if necessary, fitted for any appointment in India and the colonies, or at home, for their being thoroughly qualified scientific students of forestry, with the full knowledge of the practical application to be made of the science."—"What interests proprietors in Scotland more is the kind of smaller education to be given to the foresters to whom we pay, say from £80 to £100 a year; have you any plan to suggest which would lay down the principles for the systematic training of such men?" "I consider that if such an idea as I have thrown out were followed, such students could attend the Watt Institute at comparatively small expense. They might attend one year or more, and arrangements might be made for giving them instruction in the evening, so that they might support themselves by working in the nurseries in the neighbourhood of Edinburgh. If it were considered unadvisable that they should go through a two and a half years' course, there could be no difficulty in the professor giving a short summary of forest science in its application to practical forestry in fifty lectures or in a hundred lectures; and the attendance upon such lectures, of course, would clearly meet the case of such persons as you have referred to. I have been long desirous that forestry should be introduced into our primary schools. The arrangements made at Kensington are such as would facilitate this being done at very little expense, and thus there would be raised up a body of well-instructed woodmen, forest labourers, and others."—"Colonel Pearson told us that he thought a sufficiently practical course might be given to foresters of this stamp in three months; do you agree with that?" "I do not believe it. Referring to the views that are entertained by foresters, forest administrators who are Government officials, and professors of forest science, their general impression appears to me to be that it is desirable that when students are at college they should be at college, and that when they are in the forest they should be in the forest; that they should be at the school the whole time, except on Saturday afternoon excursions to the forest, and then spend some time—say three months, six months, or whatever time may be allowed them—in practical work in the forests."

"Where would you propose that they should go for their practical work from the Watt Institute?" "For practical work there is a number of forests which are conducted in an excellent way, and the foresters there, I have no doubt, would be willing, with the consent of the proprietors, to make arrangements for receiving such students for three months if there be a winter and a summer session, or six months if they have only a winter session. But, apart from that, an idea thrown out by Mr Mackenzie, who has charge of Epping Forest, was that a school should be established in connection with Epping Forest. And he suggested that the students should be engaged in practical work in Epping Forest, and that, after a year there, the students should go on to Windsor Forest for twelve months, or to some other of the Crown forests. I asked him if he would be willing to engage students from Edinburgh, paying them wages and engaging them in the same way as students from the home college, and he said, 'Certainly.'"—"Would the training in England be sufficient to enable a forester to carry on a Scottish forest with the different kind of trees and the different climate there?" "It is alleged that it would not. A meeting of the English Arboricultural Society was held in Newcastle a month ago, and one of the members spoke very decidedly upon the importance of having a school of forestry in the North of England, and some extensive forest at command. There is obviously an advantage in enlarging as much as possible the experience of foresters. Speaking of the Scottish foresters, I would say that I think it would be a very great advantage for them to be able to see a little of English forests, along with what they see in the management of private forests of Scotland."—"Then you think the general principles acquired, wherever the school might be, could be made applicable to the forests in which they were working?" "Yes."

"Have you any experience of the present working in Scottish forests?" "No."—"You cannot give an opinion as to whether they are scientifically managed enough to render them available for instruction?" "The management in this country is so different from that which is followed in India, and upon the Continent, that, with the exception of gaining general information, and skill and handicraft, it would not suffice."—"It would not suffice for a man who had to go to India; but would it not suffice for a man in a Scottish forest?" "It would not enable him to manage a forest in the Colonies."—"But would it enable a man to manage a

Scottish forest?" "It would be a very great advantage to a Scottish forester to have some months' instruction in a college—there can be no question about that; but it would be also desirable to have training in Scottish forests to learn the application of the principles he had acquired to the woods he had to deal with."

"In regard to the waste that is going on abroad, is it your opinion that the value of wood will increase in this country?" "Much will depend on the value of iron, and the extent to which it can be used instead of wood. One reason why so little attention has been given to scientific forestry in Britain, as compared with the Continent, is that we have fuel apart from wood at command, which they have not. We have timber brought from all countries, and valuable woods from all nations freely introduced; and therefore there has been no necessity for the same amount of attention being given to the subject here. With regard to the relative price of home-grown timber and foreign timber, that is largely dependent upon the expense of transport. In illustration of the expense of transport to the Cape of Good Hope, I may mention that we could get timber from the Baltic at less expense than we could bring it from Table Mountain at the back of the city."—"May we take it as a fact that good wood, whether from our Colonies or elsewhere, is decreasing very rapidly?" "It is decreasing very rapidly, and the effect is not only loss of wood, but also an injurious effect upon the humidity of the atmosphere."—"Is it your opinion that in a few years, if iron is produced very much at the same rate it is now, and other things *pari passu*, wood will become very much more valuable in this country than it is now?" "I have no doubt it will, from the diminished supply; and there are many purposes to which wood can be put to which iron is not now applied."—"You spoke about various places where a school of forestry might be started. For example, you mentioned the Arboricultural Society of Scotland: would you think that that was the best institution to which to affiliate a branch of the School of Forestry; would it be better than the University of Edinburgh?" "My idea is, that the School of Forestry in Edinburgh does not require for the benefit of the students to have any other affiliated with it; there would be no difficulty in getting all the experience and observation that is required in those forests without there being a separate school of forestry established elsewhere."—"Then you do not consider that it would be of advantage to ally a school of forestry with the Highland and Agricultural Society?" "I do not think it would. I do not think that a school of forestry

can be established in Scotland at present by private individuals; it is necessary that some corporate body should take it up. On many accounts I think it would be advisable that the Government should take it up rather than the Highland and Agricultural Society or the Arboricultural Society, or any existing organisation." —"Have you formed any idea as to the probable expense of such an undertaking; how much the Government would be called upon to contribute?" "I consider that the cheapest arrangement would be one connected with the Watt Institute, towards which the Government would not be called upon to contribute anything; but then there is the want of prestige, and I refer to the effect of prestige in preventing distinguished teachers getting pupils, and getting employment for the pupils when once they have passed through the course. The cheapest arrangement, combined with prestige, would be the establishment of a professorship in the University, because then we would have a definite sum, and we could not go beyond it. It would be more expensive, I believe, having a school of forestry organised in connection with the Committee of Council on Education; but it need not be much more expensive at first. The great expense would be, when once it has been seen, as I have no doubt it will be seen in a year or two years, that it is desirable to go on increasing the training staff." —"But you have no doubt that a professor in the University of Edinburgh would answer the present purposes?" "A great deal would depend upon the professor. You have no security that you would have a professor with the necessary encyclopædic information to succeed the first or the second professor, and there is very great danger of the professorship degenerating into a mere respectable sinecure. There is less risk of that, I consider, in connection with the Council of Education."—"You would hardly expect, from a practical point of view, a forester who had not had any great training in this way, except practically, to attend classes in Edinburgh over a space of three years?" "Hence the advantage of having what I may call an experimental or tentative course of lectures for one year and seeing what could be done, and then entering upon a larger course subsequently if this be found successful."—"It is your opinion that they could get sufficient information in the course of one year's lectures independently of the practical experience in the forest?" "They would get the scientific information, with illustrations of its practical application." —"Then you propose that they should go into the practical work

of forestry at a subsequent period of their education?" "Yes, and if they would attend the summer course they might keep the autumn free for this. The autumn should certainly be spent in practical work; and if there is not a summer course they should spend the whole summer in practical work. But, as has been mentioned by Colonel Pearson, on the Continent the students go great distances with the professors; they frequently go into other countries, and if they had a professor qualified to take them to any of the countries upon the Continent of Europe, and acquainted with the languages, I have no doubt that this might be satisfactorily arranged. In the last number of 'Forestry' it is suggested that they should go even to Canada."—"Your view would be that these young men should attend classes at the college as they attend other classes for the purpose of general education?" "Yes; I consider that if in connection with the Museum of Science and Art it is only necessary to have classes in forestry, all the accessory studies can be pursued either at the University or at the Watt Institute according to the means of students. If a student be able to go to the University and attend the University classes he can do so; if he have not the means or the disposition to attend the University he can go to the Watt Institute and get a thorough instruction upon the accessory subjects, leaving no necessity for anything more being done but to provide for what are strictly forest professional studies."—"But you assume that the student would have to give up both time and attention to that particular study while at the University?" "That would be exceedingly desirable; but there are many young men who support themselves by teaching while at the University; and if the arrangements of the hours were such, and a forester wished to support himself by engaging in work in the nursery, he might then attend the evening classes of the Watt Institute for all the accessory subjects, mathematics, geology, road-making, and everything of that kind."—"Then he could pursue his course of instruction during the ordinary curriculum of his University education?" "Yes."

"In this book of yours, entitled, 'Schools of Forestry in Europe,' do you agree with this remark of Dr Hooker's, where he says, 'Forestry, a subject so utterly neglected in this country that we are forced to send all candidates for forest appointments in India to France or Germany for instruction, both in theory and practice, holds on the Continent an honourable, and even a distinguished, place

among the branches of a liberal education'?" "I agree with that fully."—"Do you agree also with this:—'Wherever the English rule extends, with the single exception of India, the same apathy or, at least, inaction prevails'?" "Yes. Now, however, there is an interest taken in the subject in South Africa: there is also interest taken in it in South Australia, and a movement has been made in New Zealand since that was stated by Sir Joseph Hooker; so that I cannot say that everywhere there is the same apathy now prevailing. There has been also a movement more or less important in Canada, and a very widespread movement in the United States of America, but at the time that statement was made by Sir Joseph Hooker it was the case."—"Is it the fact that in Poland, Russia, Austria, Finland, Sweden, France, and everywhere in Germany, there have been established by the Government schools of forest science or classes in connection with existing universities?" "That is generally the case, and many of them I have visited."—"Has not this arisen, to some extent, from the fact that from the situation of those countries the supply of timber for the purposes of fuel, and also for other purposes, has not been so accessible as it has been to us in Great Britain?" "It is very largely so; but it is also the case in the United States of America, in Canada, and in many of our colonies, that the country is being ruined by the destruction of forests, owing to the effect produced upon the humidity of the climate. It is an open question—I have my opinion upon it—whether or no forests increase the quantity of rainfall: but whether they increase it or no, they certainly do affect the distribution of rainfall, both in time and space. The distribution of the forests may have arisen from the distribution of the rainfall; but the forests once established, there is a very much more equable distribution of the rain in time, and of the rain in space. Besides this, great destruction has been wrought, and is still being wrought, by inundations; and it has now been proved, beyond all question, by expensive experiments, and not only by experiments, but by extensive operations with results which have fully justified the undertaking, that there is no more efficient way of preventing inundations than planting the basin of reception with trees; and it is the most thorough way of doing so. —"In regard to the school, supposing that the students were able to spend three years at it, would you suggest that some such curriculum as is given in your book would be a suitable one for the purpose?" "It would."—"You do not attach the same importance that Colonel

Pearson did to having a practical training station upon the spot?" "No."—"You think that facilities for lectures and study should be given, either in connection with the School of Art, or in connection with the University, if it were to be in Edinburgh?" "I do, but in Edinburgh the Watt Institute is also known as the School of Art, and therefore I would say, or in the Museum of Science and Art under the direction of the Committee of Council on Education." —"And that those who profited by these lectures should have the opportunity of taking excursions into the woodlands of the district to see what practical illustrations they could draw?" "Yes, both weekly excursions into the immediate neighbourhood, and more lengthened excursions between the sessions."—"You recommend Edinburgh as the best place for such a school from your knowledge of Scotland; do you recommend Edinburgh in preference to Cooper's Hill, or in preference to any other part of England?" "In preference to any part either of England, Scotland, or Ireland. I may mention, with regard to Edinburgh, that the inhabitants have, at the expense of £20,000, purchased the arboretum with the view of its being made auxiliary to a school of forestry. In Edinburgh the first International Forestry Exhibition was held also with this in view, and some thousands of the articles sent to the International Forestry Exhibition have been transferred to the Museum of Science and Art. There we have an Arboricultural Society; all interest in Scotland in arboriculture seems to gravitate towards Edinburgh. We have extensive nurseries in the neighbourhood; we have woods at no very great distance; and an offer has been made of a cheap feu of extensive grounds, extending from the suburbs of Edinburgh to the top of the Pentlands, varying 1200 feet in altitude, and including different descriptions of timber, all tending to point to Edinburgh as a place with peculiar advantages in this point of view. Then the circumstance of having an University, where students able to pay for an University education may go for the accessory studies, and at the same time the Watt Institute, where tradesmen, and those whose means are limited, can go through a similar course of study, adds to the importance of it."—"But there are some similar advantages to be had in connection with Kew, are there not?" "If the arboretum in Edinburgh were made what it should be (it is now in the hands of the Government), I believe more might be done than is done at Kew with a view to the promotion of the study of forestry. The arboretum at Kew consists

largely of young trees; but the arboretum at Edinburgh consists largely of old trees, with every facility for making forestry a practical study."

At the meeting held on the 4th June 1886, Dr W. Schlich, Inspector-General of Forests, and at present organising the Indian Forest School, at Cooper's Hill Engineering College, near Egham, Surrey, was the first witness examined, and, among other interesting details, he gave the following valuable evidence :—

"Will you state to the Committee your exact position in connection with the Cooper's Hill School?" "I am Inspector-General of Forests to the Government of India, and, as such, I have been deputed by the Government of India, at the request of the Secretary of State, to make the necessary arrangements at Cooper's Hill for the starting of a forest school, as a branch of the college, at which officers for the forest service shall be henceforth educated."—"How long have you been in the Indian forest service?" "Close upon twenty years."—"You succeeded Dr Brandis at the head of the Forest Department?" "Yes."

"You have expressed the opinion that, although you do not anticipate any panic as regards the timber supply from abroad, still there is every prospect that in the future the prices will tend to rise, and that woods now planted in Great Britain and Ireland may be fairly expected to be remunerative?" "That is my personal opinion."—"And that, in fact, having regard to the probable falling off in our present supplies, it is very desirable that steps should be taken to secure a better supply in the future?" "I feel some difficulty in replying in a direct way to this question. The opinion I hold, personally, is that there is a fair field for investing a certain amount of capital in the production of timber. But whether I would exactly go as far as to say that it is desirable to do anything of that class would be another question. Still I think there is a fair field for investing in woodlands, provided the woods are planted upon surplus lands, that is to say, lands not required for agriculture. I do not believe that lands which are required, or could usefully be employed, for agriculture will under forest yield the same return on the invested capital as they would under agriculture."—"The question as it stands is rather of a more general character. Take, for instance, the case of Canada; you have expressed the opinion, in your very interesting memoir, that 'it is high time to take energetic steps towards the introduction

of proper forest conservancy measures' into the country; are you strongly of that opinion?" "I am very strongly of opinion that it would, as regards the question here under discussion, be one of the most important measures which the British Government could take to introduce a proper forest conservancy into Canada." —"Then, as regards planting in Great Britain, are you of opinion that the surplus area is so great that extensive tracts could be set aside for forests without trenching upon the land required for agriculture?" "There is a considerable area of waste land, the details of which are given in my report."—"And though you do not wish to put the matter too strongly, the impression upon your mind is that a fair field for judicious enterprise exists in the extension of the woodlands of Great Britain and Ireland?" "Yes, provided it is done in an economic manner."—"As regards Ireland you have expressed the opinion that there are probably 2,000,000 acres which might be advantageously planted in that country?" "That is a rough estimate; about 2,000,000, I should say."—"Those 2,000,000 acres, as they stand at present, make a very small return; and you say that the 'afforestation could, I have no doubt, be made to pay fairly, apart from the benefit which the people in the poorer coast districts would derive from the increase of work afforded near their homes, and the protection which the forests would give to the adjoining fields, and to cattle;' that is still your opinion, is it not?" "It is my opinion." —"You attach great importance to the planting of parts of Ireland, not only on account of the value of the products that would be derived from them, but also from the protection that would be given to the cattle?" "Yes."—"As regards England, you say, 'The total area of all waste lands amounts to 41,890 square miles. I am not in a position to state, at present, what proportion of this area is fit and available for forests, but on the whole it may, perhaps, be estimated at one-half, or 20,000 square miles in round figures. At any rate it is evident that there is sufficient room for a considerable extension of the woodlands in Great Britain and Ireland.' Is that still your opinion?" "As far as the information at my disposal goes, that is still my opinion."—"You said, very truly, that in expressing that opinion you think it quite necessary that the planting and management of the woodlands should be economically and judiciously carried out. The establishment of a forest school would be a very important thing in that point of view, would it not?" "There can be no

doubt that the establishment of a forest school would be of importance, because it would be likely to disseminate better views with regard to the management of woods."—"Are you prepared to state to the Committee what the present arrangements are at Cooper's Hill with regard to instructions in forestry?" "The Secretary of State in Council selects every year a certain number of young men from among those who have qualified in an examination held by the Civil Service Commissioners. For instance, last year he selected five, and this year he has advertised for eight. There is a competitive examination held, and from those who stand at the top of the list he selects those whom he considers best suited for the appointment. Generally he begins at the top and takes those standing at the top, provided there is nothing against them; if there is anything against one of them he can strike that one out and take one lower down."—"Until now those young men have been sent abroad for their actual forest instruction. At first a certain number were sent to France, and a certain number to Germany, but latterly they have been all sent to the forest school at Nancy?" "Yes."—"Is it proposed that they should still go abroad during any part of their instruction?" "Yes; they enter the ordinary course at Cooper's Hill in September of each year. They go through the ordinary course, generally speaking, until Easter; and then at Easter they drop certain subjects, such as mathematics and geometrical drawing, and we substitute for those subjects botany and instruction in the different branches of forestry. Then, at the end of the first twelve months, they drop most of the curriculum subjects, retaining only a few, as, for instance, surveying and physics; and their time is principally employed in the second year in the study of botany and the different branches of forestry, entomology, and, we hope, in acquiring also some elementary knowledge of law; but the arrangements for that have not yet been made, because we have not yet arrived at the second year. At the end of the first year the present arrangement is that the students are taken for a short trip to the Continent for about three weeks, to a particular forest managed in such a way as will be most useful or most instructive to our Indian forest officers. They have to study the system of management in that particular district as closely as it is possible to do in the time. That is the autumn of the first year; and then, in the second year, having completed their theoretical subjects, they would be taken for three or four months

again to forests upon the Continent to study forest districts in various places and their management, to see the way in which the principles which they had been taught in the classroom are practically applied. We also use the forest near Windsor; and I also expect that they will be taken on occasional visits to the New Forest, Forest of Dean, or to some forests in Scotland."— "Are there any facilities given to students who are not intended for the Indian Forest Service to take the course at Cooper's Hill?" "No actual orders have been passed by the Secretary of State upon the subject, but I may confidently state that every facility will be given to outsiders who want to join the course, and I have just heard that one young gentleman proposes to join in September to study on his own account."

"Would outside students join the whole course, including engineering, or would they join the forestry course only?" "There are many who join the course on their own account; in fact, all who take the chance of obtaining an engineer's appointment at the end of three years. We propose that this school should be made use of by those who are not directly interested in Indian forestry. But the difficulty of not following the same course as the Indian engineers is, that those who fail to obtain employment in the forest service of India have a difficulty in finding employment elsewhere; whereas an engineer can always find work if he has failed to get into the Indian service. Having gone through the whole engineering course, he can almost certainly get employment elsewhere, whereas if the arrangement for the forest service of the Indian Government were an open one, and a certain number of appointments were offered for employment in India, those who failed to obtain them would probably be perfectly unable to obtain employment."

"The Committee have been informed that, at the present moment, there is a large demand for gentlemen skilled in forestry, and that there is no means of getting them; that in the case of a colony requiring such persons to take charge of their forests they have been obliged to appoint foreigners, through not finding any properly qualified Englishmen to discharge the duty?" "That is so to a certain extent; but as far as the Indian Department goes, which has been mentioned in connection with that point, I should be anxious to correct a slight misapprehension by stating that the Indian Government has been most anxious throughout to assist the various colonies in that direction; and we have sent Indian

officers to various parts of the world, to the Cape, the Mauritius, Ceylon, and Cyprus, for example; but those men are always returned to us again, for this simple reason, that the Colonies will not offer proper conditions. They want to have the men, and be able to discharge them again at their will and pleasure. At the same time, the Government of India, although ready to help the Colonies, says, 'We cannot let you have experienced men for the best portion of their working time, and then take them back again when they are becoming due for pension; that is not fair. We will help you, but you must offer those men proper conditions, and if you want them for any length of time you must take them on permanently.' The result up to the present day, with one single exception, has been that the men always return to us; but we have been always ready to let the Colonies have the men if they will take them on permanently."—"Has the Indian Forest Service at the present day a larger number of officials than it requires?" "It has not; but it has always been considered good policy to help the Colonies in this way. We have a staff of about 160 superior officers, and if we let one of the officers go away, we can do with 159 until we replace him. The young men sent out from England are supernumeraries until they are absorbed into the regular scale, so that we can fill up a vacancy in the course of a short time."

"Do you think it would be better, if a forest school were organised for this country, that it should be a Government institution, rather than that the endeavour should be made to induce a private institution to develop a course of forestry instruction?" "I should think, generally speaking, it would hardly make any difference whether it were a Government or a private institution, provided instruction were given upon the right lines." —"Colonel Pearson expressed strongly the opinion that, whether it were a private or a Government institution, it was necessary for it to have access to a certain amount of woodland of a character suitable for the purpose; do you concur in that view?" "To train a real forester it is absolutely necessary."—"Dr Brown was rather of opinion that the instruction might be given mainly from lectures and books; but you agree with Colonel Pearson that it would be necessary to have access to, and control over, a suitable extent of woodland?" "Will you let me explain what I mean a little in detail? If it is a case of officers of the class we educate for India, or if it is a case of educating practical wood managers

for this country, then it is absolutely necessary to have access to some forests in the vicinity which are managed in such a manner that they are fit to serve as training grounds. If, on the other hand, it is a question of giving some general ideas of forestry to land agents, as I have heard mentioned, that is to say, to gentlemen who manage large estates, but are not supposed themselves to carry out the real forest work, then a course of lectures might be arranged with occasional visits to some more distant forests. I should like to make a distinction in that respect."—"As a matter of fact, the Continental forest schools have in most, if not in all, cases tracts of woodland open to them for the purpose of instruction?" "Yes, that is true; in most cases they are immediately attached to a school."—"Is it the invariable rule, or are there exceptions?" "It is not the invariable rule. I went last year to look specially at three of the principal forest schools in Germany. In the case of two of them, namely, those at Giessen in Hesse Darmstadt, and at Tharand in Saxony, the schools are in immediate connection with forests. A third, which is probably the principal forest school in Germany, is that at Munich. There the forests are not immediately attached to the school; but there is a reason for that. The forest school there is part of the University, and the students who study there are expected to have already spent two years at another forest school of a class where there is a forest attached to the school, that is to say, the aspirants to forest appointments in Bavaria go to Aschaffenburg, where they study for two years, and there are forests immediately connected with that school. Having done that, they proceed for two more years to Munich to study forestry from a more general point of view, with the view of obtaining ultimately the highest appointments in the forest service of the country. I wished to explain that there was a special reason why there are no forests attached to this great forest school at Munich, where there are six professors of forestry, apart from the ordinary university professors."—"And even in that case the students are expected to have passed a part of their course in schools which have a forest attached to them?" "Yes, to do the thing properly, it is absolutely necessary to have control over a certain area of forests in the vicinity of the school."—"Now, with regard to the lower class of those who are employed in the management of woodlands, say, the bailiffs and wood-reeves, would you consider that in their case also a certain amount of

forest instruction would render them much more valuable as forest officers?" "I have no doubt it would."—"You think that even if they went for a three months' course, that would give them, though not complete instruction, still an amount of instruction which would be extremely valuable?" "Whether a course of three months would do that, I am not prepared to say. The curriculum for men of that class would have to be to a very large extent of a practical nature; we would do best for that class of men by letting them work, as it were, in a sort of sample or pattern forest, and augmenting that by a series of simple lectures upon the most important subjects; as, for instance, a certain amount of botany, and a certain number of lectures on the principal sylvicultural subjects and the system of management generally. What I mean to say is, that it would be essential that a great portion of their training should be of a practical turn, and that therefore to do it without a forest immediately accessible would be simply impossible."—"Are you aware that there are a great number of landowners in this country who have a certain amount of woodlands, but not a very extensive amount, and that therefore it would not be worth their while to employ any person at a high salary, but who yet have to employ wood-reeves and wood-bailiffs; and from the answer you have just given it seems that the practical instruction to which you have referred would be of considerable value?" "Yes. If I were an owner of woods in England myself, and wanted a man of that class, I should, in the present state of affairs, probably send him as an apprentice for some time to one of those shrewd Scottish wood-managers; or if there were a suitable school to which a forest was attached, which was managed in a satisfactory way, I should send him there for a time, so as to let him get a certain amount of theoretical instruction."—"Would you kindly supply the Committee with a rather more detailed statement as to the mode in which you would suggest that a forest school should be organised, having regard in the first place to the higher grade, and secondly, to the requirements of wood-reeves and wood-bailiffs?" "I shall be most happy to supply that."

"You have spoken of an area of 2,000,000 acres in Ireland as suitable for planting; what is the general nature of that ground; does it include bog?" "Yes, to a considerable extent."—"There is a great deal of bog which is unsuitable for planting, is there not?" "Yes, there is, but there is also a great deal that is suit-

able; anything that can be drained is suitable."—"Of course you are aware that a great deal of the Irish bog could not be drained from want of fall?" "That is so. I was only a short time in Ireland, and this report, from which the figure is taken, was written at the request of the Lord-Lieutenant of Ireland. I could only make a guess to the effect that probably half of the available area is fit; I could not go further than that."—"Have you formed any estimate of the amount of waste land available for planting in Scotland?" "I believe the area is very much larger than it is in Ireland; practically 70 per cent. of Scotland is waste land."—"But it is not all suitable for planting?" "Not all, but I should say a very good proportion was."—"Have you estimated the effect of climate and of violent gales, especially in the north part of these islands, upon the value or the profitable nature of planting?" "The violent gales will, no doubt, affect the returns where the woods are directly exposed to them, but I do not think that the loss would be so great as is generally assumed."—"The late Duke of Buccleuch spent a great many years in planting a large extent of the south of Scotland; and a year or two ago, in 1883, two successive gales came, and it was estimated that 1,250,000 trees went down; have you any knowledge of a similar occurrence on the Continent?" "I was, last September, in a large forest district called the Bavarian Forest, which does not mean the forest of Bavaria, but is a particular very extensive district running near the boundary between Bavaria and Bohemia. I was not prepared for this question, and I could not give the exact area, but it is a very extensive forest district. In the year 1870, if I remember rightly, they had a gale in this large extent of forest which threw down so much timber that, in spite of the efforts of the officers in charge (and the management is a very good one), all the available labour had not removed all the timber in 1885 when I was there; that was fifteen years afterwards; some of it was entirely rotten."—"That of course would entail a very great loss?" "A very considerable loss."—"You alluded to Scottish foresters, and you were kind enough to call them 'shrewd;' do you think there is a more practical knowledge of forestry in the north than in the south?" "I do not know that; but I think there are more extensive forest lands in Scotland in the hands of one owner, and therefore, probably, there are better forests there. There is more appearance of development in Scotland."—"Your observations lead you to

the conclusion that all over the country there is a great deal of waste by ignorant planting and subsequent ill-management?" "I should be afraid to give a precise answer in a few words to that. In my opinion, the best forest management of any area is that which is most in accordance with the wish and desire of the owner of that forest. Now the intentions and the wishes of owners of woodlands in England are often peculiar. One man may simply desire to produce beautiful trees; another may desire to produce timber of a certain class; a third may desire to produce the greatest possible quantity of timber that can be obtained from a certain area. Another may desire the highest annual return in money; another may wish to have the highest possible interest upon the invested capital; and another may make it subservient to shooting purposes. Those are all different aims and objects; and I maintain that the man who manages the forest most in accordance with the intentions of the owner is the best forester."

"The ultimate profit of woodlands depends very much, does it not, upon the way they are originally planted; whether the trees are suitable to the soil and the situation?" "Very much indeed."—"Do you think that there is a considerable want of men in England who are capable of advising owners of land as to that matter?" "I think there are a good many wood-managers in England and Scotland who are very well able to manage their business properly if permitted to do so."—"The usual men who advise owners in England are land agents, and, as a rule, those gentlemen have but small opportunities of acquiring a knowledge of forestry; do you think it would be a great advantage generally that they should have an opportunity of obtaining a certain amount of knowledge of forestry, and the management of woodlands?" "I should think that would certainly act very beneficially."—"And there would be no difficulty in making arrangements for that knowledge being given to land agents and others of that class if there were a forest school attached to Cooper's Hill?" "It would require special arrangements for gentlemen of that class."—"Do you think those arrangements could be made?" "Yes, they could be made."

"You stated that it might be well to send students to the Highland forests to study planting there; that would indicate your belief that the woodlands are sufficiently well managed to make them available for instruction?" "I would take the

students there, because there are a great many things for them to see, but they could not see everything. I am now speaking of the pupils I am directly interested in training for the Indian service; they could not see everything in Scotland."—"M. Boppe expressed an unfavourable opinion of the management of the woodlands in Scotland, and said that they were not managed upon scientific principles; have you any knowledge of their management in those parts?" "I spent a fortnight there last year; I went into some of the Highland forests, and came away with a very high respect for some of the wood-managers I saw there. If the forests are not in every respect managed upon so perfect a system as gentlemen accustomed to look at it from a different point of view and under different considerations might think desirable, the reason generally was that the forester had to give way to other considerations than those of merely scientific cultivation. I came across certain men who knew very well how to manage forests, and whenever I criticised and said I would not have managed a wood in the way it was actually done, I always found that they knew how and where the mistake was; but they were also invariably able to give the explanation that it was the result of different considerations upon the mind of the owner. At present the foresters have to acquire their knowledge by a very laborious, and to the owners of the land a very costly, process; that is to say, by experience spread over a large period of years; whereas if we had a suitable forest school we could, by gathering the experience gained in various parts of the country together, teach them in a couple of years what, perhaps, it takes men of their class twenty years to acquire by personal observation. That is the principal advantage of a forest school; that it enables us to teach a young man in a limited space of time what he may otherwise spend half his lifetime in finding out."—"During which time he may make a number of expensive mistakes?" "Precisely so."—"In your opinion are Scottish forests sufficiently well managed to make them available for the instruction of those gentlemen?" "As they stand now they are not."—"Then why do you recommend they should go there?" "I can show my men many points there; I can show them how in the most admirable manner to plant forests; and they probably would see that better in Scotland than elsewhere; they might go a long way on the Continent before they would see planting so excellent as they would see in Scotland."—"Then what is the

defect?" "That the management becomes irregular afterwards."

"In addition to the forest ground that you would set apart for the use of the school, you would acquire ground for experiments in planting as well as in the treatment of trees?" "That we should do in that area."—"There are many parts of the country in which certain trees are better adapted to the soil than others?" "We could not grow everything; we could only in an area of that class show the treatment of a few species. But the object would be to teach the pupils the general principles on a few species; and then, understanding the treatment of a few species thoroughly, they would be easily able, by taking them to some other localities where other species of trees are grown, to understand in a short time how to treat others."—"So that you would have to take the students not merely to Scotland to show them the treatment of trees, but to take them to other parts of England?" "We could not transform the present area which might be made over to us into a suitable area in a hurry; it would be a slow process."

"Are you acquainted with Ireland at all?" "I spent three weeks in Ireland last year. I went to Cork and Bantry, and across to Killarney and Tralee, and thence to Limerick, thence to Galway and Clifden, and thence I went *viâ* Westport to County Mayo, Bangor, and Belmullet, to County Sligo, through Donegal, along the north to Coleraine and Londonderry. I went round Lough Neagh, Belfast, and County Down, and then to Dublin."—"You did not see many trees, comparatively speaking, upon the coast?" "No."—"You are aware that in Queen Elizabeth's time the country was densely afforested?" "So I understand."—"You, perhaps, know that it was densely afforested; you could see the axe-marks upon the stumps?" "I did not see that; but I have seen stumps of trees in many of the peat mosses; there is no doubt that there were forests there."—"Then there is no doubt that it would be capable of growing trees if it were properly planted?" "There are proofs to that effect in the woods now standing there; I have seen even beech growing upon the west coast of Ireland within half a stone's throw of the coast."—"We may take it that the forests in Ireland have almost entirely disappeared?" "There is a very small proportion now under forest."—"That is from sheer neglect and waste?" "It has been cut down for various purposes and never been replanted."

"You suggested that it would be well for English landowners

who own woodlands to send their wood-reeves to a Scottish forest to learn something of forestry?" "Perhaps I should be careful not to put it quite so general as that; to a *good* Scottish forester, I would say."—"Would it not be the case that the instruction there would be somewhat imperfect, in view of the difference in the climate and the flora of Scotland from that of the south of England; for instance, the Spanish chestnut would not be found in the north of Scotland?" "The statement I made was to this effect, that I should send him to a Scottish forester in the absence of a forest school; but, if there were a proper place for training, I should send him to the forest school."—"Do you think it would be better to have a school for England and a separate school for Scotland?" "I do not think the climatic difference between Scotland and England is so great as to make it necessary to have two schools for the two countries."—"Would there not be a great difference geologically?" "That opens a very large question. It is generally found that, with few exceptions, most of our timber trees do not mind what is the geological origin of the soil so long as it has certain physical qualities; so that the geological question would hardly come into consideration."

"In the paper handed in last year, containing the report by M. Boppe with regard to English and Scottish forests, it is stated that 'in the low-lying districts at an altitude of from 250 to 300 feet we found growing, both singly along the roadside and collectively in forests, magnificent specimens of oak, maple, elm, ash, beech, and lime.' And again, 'The mountain vegetation commences at about 400 feet above the level of the sea;' now, in the county of Surrey, would it not be the case that the deciduous vegetation, if you may call it so, the beech, the oak, and other trees, would grow at a higher altitude than they would in Scotland?" "If I correctly understand the drift of the question, I do not think that M. Boppe meant to say that that was exactly the limit; I believe that the distribution is to a very large extent quite artificial, according to what has been planted. I believe that in Scotland they plant the beech in the lower parts near the parks and places of that sort, and that in the mountains they plant more fir. At the same time it is quite correct that the oak in Scotland will not grow at so high an elevation as it will in England, nor in England will it grow so high as it will in France."

"You were good enough to give the Committee a rough estimate of the amount of acreage of waste land in Ireland and in

England. In Scotland you said that 70 per cent. of the land was waste; you have not stated how much of that was suitable for planting?" "That would require a very detailed inquiry. I gave a rough estimate for the three countries together, and then I dealt specially, at the request of the Lord-Lieutenant of Ireland, with Ireland. The one estimate of 20,000 square miles refers to England, Scotland, and Ireland."—"Of the 70 per cent. in Scotland which is waste, according to your statement, have you made any estimate of what is really suitable for planting; have you considered in any way how much of the 70 per cent. of waste land is at such an altitude that it is not likely to pay for planting at all?" "There is a portion above a certain altitude which cannot be planted, but I cannot say at present how much that is." —"Would you give the Committee any idea of the limit where you have seen the larch in Scotch forests?" "I think the larch in Scotland does fairly well up to 2000 ft.; above that it does not pay. I have seen it planted up to about 2500 or 2600 ft., and I thought that it did fairly well up to about 2000 feet. Probably it would have been better if they had stopped at about 1800 ft.; in some parts they might go up to 2000 ft. It depends a great deal upon the locality, but I do not think it would pay generally to plant it above 1800 to 2000 ft."—"In the event of a forest school being established in connection with Cooper's Hill, would you recommend that all young men from Scotland should be obliged to come so far as to the south of England in order to obtain the information and knowledge which is desirable upon that subject; because the distance from the north of England or Scotland, where we want a number of young men trained in forestry, would be a considerable element?" "I should say it is a matter of expense. If you have money to establish the two forest schools, it would be better to start the two; if you have not the money, and, what is also a very important thing, if you have not yet a sufficient number of people to select your teachers and professors from, it is probably better to begin with one school."—"Upon the whole, if the conditions were favourable, you think it would be more satisfactory to have, in addition to the school at Cooper's Hill, a forestry school in Scotland?" "I am not prepared to subscribe to that statement. There would probably be a great deal of difficulty in making satisfactory arrangements in one place, and if you start with two or three places the difficulties would be doubled and trebled. It is, how-

ever, principally a matter of expense; if you can have two schools so much the better."—"We have been told in this room that it would be desirable, in addition to there being a forestry school in England, that there should be a similar establishment, or possibly two similar establishments, in Scotland. Do you consider a similar establishment, if it could be arranged, would be as desirable in Scotland as it would be at Cooper's Hill?" "To begin with, I do not think there would be a sufficient number of men to fill two schools."—"But the amount of the woodlands in Scotland being so large, are we not likely to require the advantages of education in forestry quite as much as those who are further south?" "No doubt; it is simply a matter of expense; of course it would be desirable for the Scottish foresters to have the school nearer home."—"We have heard that if it is desirable that there should be one school of forestry in Great Britain, it is highly desirable that it should be upon the other side of the Tweed and not upon this?" "There may be a practical reason for its being at Cooper's Hill. Seeing that we have already got an establishment at Cooper's Hill, and that the Government of India will probably always select the best men they can find to conduct that business, you have already offered you there conditions which you might not be able to find elsewhere, therefore it would be probably easier at starting to make a beginning here than in Scotland. But I will go so far as to say this, that if Cooper's Hill was at Perth, and the Government of India had made arrangements for training their officers at Perth, it would be certainly better there than that it should be at Cooper's Hill. The forests round there could be much more easily brought into condition for teaching than round about Windsor."—"If the thing were first starting, you think that Perth or somewhere in the neighbourhood of the large Scottish forests, would be better than the establishment of a forest school in the south of England?" "If I started with everything blank before me I would have the school in Scotland."—"With regard to the low price of home-grown timber, you mentioned the intermittent character of the supplies from our woods, and Sir Herbert Maxwell asked you a question with regard to the destruction of the Duke of Buccleuch's woods in 1883. Could you suggest any way in which we could avoid these intermittent sales of timber, which, as you say, diminish our profits; or could you tell the Committee of any way than by casual operations we can increase our sales?" "I

believe the large Scottish forest owners would very considerably increase their returns from the forests if they decided to work their forests systematically. Supposing those lands were in the hands of the State, and the State were to say, we will make a working plan of operations; we will cut down so much every year for the next thirty years. Suppose the Government made an announcement of that sort, the result would be that enterprising people would take to trading in timber, because they could rely for a series of years upon a stated quantity being thrown into the market. Under present circumstances a Scottish owner one year cuts down perhaps a 1000 acres, and the next year perhaps some other consideration arises; perhaps he does not want money, or somebody gives him £1000 for the right of shooting the deer upon the forest; then the merchant will be left high and dry."

"You made a distinction, as regards the management of woods, between woods managed upon commercial principles and woods managed according to the express views and tastes of the owner?" "I made that distinction."—"Looking upon this question purely in a commercial light, do you think that the establishment of a school of forestry would tend to increase the value of our woodlands by drawing attention to the defects in the management of our woodlands as a question of commerce, quite apart from the treatment of timber according to the views or tastes of the owner?" "I think it would; it would be a saving of time if nothing else."

"Do you think the remark has had any foundation, that more success would be attained if greater care were paid to planting protection belts round the conifers?" "There are some plants which are flat-rooted and some deep-rooted. Upon the Continent they pay great attention where there is danger anticipated from storms to having deep-rooted species upon the windy side. There is no doubt more attention is paid to that on the Continent than there is in Scotland; I have seen in the Thuringian Forest mixed forests of spruce and silver fir; the trees were standing in rows; and upon the windy side, where they had for the leading tree a silver fir, they stood well, and where the leading tree had been a spruce they were all blown down."—"Do you think much of the damage which now occurs might be prevented by the adoption of some such principle?" "Yes, very much; but damage by storms will always occur."—"As to whether there should be one or two schools of forestry, that would depend upon the number of

students that would be likely to go there. In your opinion it would be better to have one well-equipped school than to have two not so well provided?" "Yes, certainly; I believe that for some years to come there will not be more students than could be properly taught at one school."—"You do not think that the distance the students would have to come would be so important a consideration as that of having a forest school thoroughly well equipped?" "I think not."—"Do you consider that one advantage of a forest school would be, that there might be a certain amount of research into different questions as to the habits of insects and other matters of that sort bearing upon the management of woodlands?" "That is a matter I attach special importance to; it will form a centre of research upon questions connected with all departments of forestry; the facts as they are observed in different parts of the country will be brought together."—"You think we have a great deal to learn which even the most experienced foresters are not acquainted with?" "A very great deal indeed."—"And you would attach great importance to the mere fact of teaching young men what we ourselves have observed?" "I would attach very great importance to that."—"At Cooper's Hill you are proposing to utilise, for the purpose of instruction, certain portions of Windsor Forest?" "If they can be made available."—"That is the idea?" "Yes."—"Have you visited the Forest of Dean?" "I have spent a couple of days there."—"The Windsor Forest has been chosen mainly as being nearer Cooper's Hill?" "It has."—"Would the Forest of Dean be as suitable?" "The Forest of Dean in its present state is very uniform; there is not much variety; it is principally oak."—"Then it would be good as far as the oak is concerned, but not good in other respects?" "I do not think the Forest of Dean is of a specially suitable character for our purposes; it is too uniform."—"Are there any other woodlands in this country that you think would be suitable?" "I should say that even the New Forest would be a better field of instruction than the Forest of Dean, because there is more variety."—"You think that there are in the New Forest woodlands which might be suitable for the purpose?" "To a certain extent."—"Reverting for a moment to the question with reference to belts of hardwood trees as a protection to the growing firs, would trees, such as the birch, for instance, grow up quickly enough to give protection, because that protection is required mostly when the firs have grown to a con-

siderable height; would the birch be suitable for that purpose?" "It would be suitable to a very fair extent; but it is not one of the best. The birch is not a very deep-rooted tree, but it has a thin crown, and consequently it is not often thrown. There are other trees which would stand more firmly, but in many places the birch in this respect is a very useful tree, where perhaps it would not be possible to grow another tree that would stand more firmly."—"The beech would be suitable, would it not?" "Where the birch would come in the beech would probably be out of the question; the birch is a much harder tree, and it has an enormous power of accommodation; it will accommodate itself to almost any circumstances."—"What sort of height would you consider that a tree would require to grow to be a protection to the firs; because the time of great danger to our Scottish woodlands would be when they were from thirty to forty years old?" "Old trees are much more liable to be thrown than young trees; the fringe would grow up with the rest of the forest."—"In one case you would have a slow growing hardwood tree and a very fast growing softwood tree?" "No doubt."—"But the birch answers very fairly as a belt, and breaks the wind to a very considerable extent?" "It does break the wind to a considerable extent."

"From what you say it appears that there would not be a very great demand for men who have acquired technical knowledge in regard to this question after two or three years' study?" "I understand you to mean men who have gone through an extended course of two or three years?" "Yes?" "I do not think that outside the Indian Forest Department the demand would be very large."—"If there were such a class of men as independent men in private practice, it seems to me that they would fulfil the want referred to, by going out and advising landowners in regard to private properties?" "I have a difficulty in replying to that question, for this reason, that even men who have been trained in a course of two years or so would not be the proper persons to be employed as advisers upon such a matter as forest management; generally speaking, they would be good managers of a forest estate; but for giving advice after an examination of a limited duration nobody should be employed who had not had some years of practical experience himself in a forest; owners would probably save a good deal of money by attending to this."—"In view of the forests of this country being in the hands of private owners, is not there a great need that those who manage those forests for

the private owners should have an opportunity of acquiring technical instruction in forestry with a view to their conducting the business of their employers?" "I have no doubt that there is a certain demand for that talent."—"Do you think that that instruction could be given by the School of Forestry?" "All those things are matters of expense; that could certainly be arranged."

"With regard to what you have said as to there not being a large demand for forest officials, we have in our colonies an enormous tract of woodland, have we not?" "Yes."—"And none of them have any forest school at all at present?" "No, I do not think so."—"Would it not be likely that if there were a class of English speaking officials, the colonies would be very glad to avail themselves, and they would be very wise to avail themselves, of their services?" "They would be very wise indeed. I think I have heard of almost every case of that class which has turned up, where a man was wanted for the colonies; and I think it is a melancholy fact that I could count them almost on the fingers of one hand. At the same time I have no doubt that many of the colonies are waking up to the importance of the matter now, and that some years hence the demand for men of that class will very much increase."—"The attention which has been called to the question will probably lead the colonies to pay more attention to their woodlands in the future than they have done in the past?" "I have no doubt it must come to that."—"Do you not think that large landowners would be willing to get the services of men who have been thoroughly trained rather than to take the advice of men who had gained their experience through a series of twenty years of expensive mistakes?" "If they consulted their purse no doubt they would."—"You think there would be a considerable desire to gain that training?" "I think it would be a very good step to do so; but whether we should secure at first a large number of pupils I doubt. It was in regard to whether there should be two schools that I said there would be at first but a small demand, but after the school had been established and successfully carried on I have no doubt there would be a large demand for the education."

Mr Julian C. Rogers, Secretary to the Surveyors' Institution, who had been examined in 1885, was next called and re-examined.

The evidence now given by him was chiefly in support of the Institution he represented, and the advantages of a theoretical knowledge of forestry to land agents. In his advocacy of the importance of a knowledge of forestry to land agents, he stated "that a great point would be gained if the present race of land agents, *who are the only possible foresters*, were provided with some means of acquiring scientific information with regard to the management of woods." Much evidence in the same strain was given by this witness, but as it had nothing in it of a practicable nature, there is no necessity for an extended report.

The last witness examined was Mr Alexander Mackenzie, Superintendent of Epping Forest, who furnished the Committee with much important information, the result of a long experience, concerning the neglected condition of the woodlands in Hertfordshire, and other parts of the country, and also bore strong testimony to the great advantages that might be derived from their proper management by a trained and educated race of foresters.

This finished the evidence taken in 1886. It is to be hoped that circumstances may be more favourable during the Parliamentary Session of 1887, for the completion of the duties of the Committee. Landowners and foresters are looking forward with anxious interest to the finding of the Committee, in the hope that a practicable solution may be obtained of the important question set before it.

XVI. *Specifications of Works to be Executed in the Erection of a Forester's Cottage; with Plans and Sections.* By Wm. MacIntosh, 5 Thistle Street, Edinburgh.

(*See Plate XI for Plans and Sections.*)

Mason Work.

Excavations.—The site shall be properly prepared for the reception of the building, and cleared of all the surface soil, which shall be deposited in a place to be pointed out by the Inspector. The track for the foundation shall be dug out to the solid subsoil; and all making up must be of solid building; but in no case shall the upper bed of the scarcement be nearer the finished surface than 12 inches, as shown by sections.

Contractors must examine the ground as to the nature and level of same, as no extra price will be allowed for excavating or building extra foundations.

Materials.—The stones shall be taken from Whitehouse Quarry, and shall be of the best quality of rock from that quarry. All stones used for dressed work must be thoroughly sound and free from clay pits, iron stain, or any other blemish.

The bricks used shall be well burnt, of good sound quality from Hillhead Brickworks, 9 inches by $4\frac{1}{2}$ inches by $2\frac{1}{2}$ inches. The lime used shall be from Woodend Limeworks; and the sand used to be clean, sharp, or river washed, free from salt or vegetable matter; and the cement shall be Portland, weighing not less than 110 lbs. per "striked" bushel.

The mortar to be composed of one part lime to two parts sand thoroughly soured and sifted together, and to remain not less than eight days in the souring heap, and to be well mixed and beaten before being used in the works.

Building.—The foundations to be formed of large flat-bedded stones laid on their natural beds, header and stretcher alternately, having all their joints well packed and flushed with stone shivers and mortar, to form scarcements 4 inches wide on each side of walls, as shown by sections, and where there are wood floors the scarcements shall be 7 inches wide to receive the wall plates for the joists. The whole walls over the foundations (with the after-mentioned exception) shall be of the best quality of lime-built rubble masonry, and no stone used in the face of the building to be higher than 10 inches. Bond stones shall be placed in each course at distances

not more than 5 feet apart going two-thirds through the wall, and built from outside and inside alternately. Dwarf walls must be built under all wood and brick partitions and sleeper joists on ground floor. The walls to be hand-packed and hearted with stone and lime, sneck-harled inside, and clean pointed and cut off at every levelling outside. Inbonds, rybats, and scuntions to cross the wall, and to be 8 inches thick, and outbonds to be 21 inches long. The partition between the back wing and parts of sitting-room and parlour to be of bricks, built with a good firm bond. Bond-wood, which shall be provided by the carpenter, and shall be built by the mason into all walls, except coal place, in a horizontal position at distances 20 inches from centre to centre. Chimney vents to be lined with fire-clay vent linings—those for rooms and bedrooms to be circular 9 inches diameter, the kitchen vent to be oval 11 inches by 13 inches, and all to have fireclay oncomes. The vent linings to be taken 6 inches through the chimney cope, and finished with a roll. Chimney cope to be in pieces to breadth the top, and batted together with iron bats run with lead. Four openings, 4 inches square, to be formed in the walls to admit air to the sleeper joists. These openings to be furnished outside with cast-iron gratings, and securely batted into the stones with lead.

The floors of kitchen, pantry, coal place, and passage leading from back entrance door to same, shall be brought up to within 3 inches of door soles, with broken stones well packed, at least 6 inches in depth; above this 2 inches of concrete will be laid in the proportion of one part cement to five parts sharp sand and shingle, well mixed together, and to be finished to the level of door soles with 1 inch concrete in the proportion of one part cement to one part sand, properly smoothed over and hand floated.

Dressed Work.—The rybats, corners, spurstones, skew-tabling, chimney heads, corners and coping mullions, soles, lintels, jambs and lintels of fireplaces, arch stones and finial of porch, shall be chisel droved, and scuntions inside to be well squared; upstarts of roof windows, door soles and steps, and hearthstones shall be scabbled.

Hearths.—The hearths on ground floor to be scabbled freestone, 3 inches thick, laid on a foundation of solid masonry, and hearths of upper floor to be of the same material and thickness, but to be bedded in concrete formed of one part cement to three parts sand, resting on strong deals laid by the carpenter—these hearthstones to have 4 inches hold of wall.

Grates.—Grates shall be provided and laid down at the building free of charge by the employer, but shall be securely built into their proper places by the mason.

The contractor to leave all holes in walls for beams, etc., and do any boring necessary, and to build or cut all raggles, beamfill the wall heads after the roofs are set, and execute all jobbing required to finish this department of the work in a tradesman-like manner, and leave the same complete in accordance with the foregoing specification, general conditions, and plans to which they refer.

(*See General Conditions.*)

Carpenter Work.

Materials.—The window sashes and cases, outside doors and their posts, shall be of Baltic redwood. The inside finishings of rooms and bedrooms, the doors of same, and staircase, shall be of Norwegian whitewood; and the roofing, sarking, joisting, safe-lintels, and all other wood-work in connection with this department, not otherwise specified, shall be of matured grown, well-seasoned Scots fir.

Safe-lintels.—Safe-lintels shall be placed over all voids not less than $1\frac{1}{4}$ inches deep for every foot in span, and to have 9 inches of wall hold.

Joists.—The sleeper joists of ground floor to be 6 inches by $2\frac{1}{2}$ inches, placed at 18 inches from centre to centre; and the joisting of upper floor to be 9 inches by $3\frac{1}{2}$ inches, and to have 9 inches of wall hold. The joisting and roofing to be carefully bridled for stairs, hearths, windows, and skylights, and all joists and rafters shall rest on wall plates 7 inches by $1\frac{1}{4}$ inches.

Roofs.—The roofs to be constructed as shown by sections, and will consist of rafters and ties 6 inches by $2\frac{1}{2}$ inches, checked at the joints, and securely nailed with patent-cressed spikes, two to each joint, and of sufficient length for $\frac{1}{2}$-inch rivet after going through. The roofs and framing of windows and roof of porch to be of timber 4 inches by 2 inches. At joining of roofs the diagonal rafters to be 7 inches by 3 inches, and ridge 8 inches by $1\frac{1}{2}$ inches. The sarking to be $\frac{3}{4}$-inch thick, closely jointed and securely nailed.

The skylights to be of cast-iron, having proper flange frames, hinged, and having sprent bars; that over staircase to be 36 inches by 24 inches, and all others 18 inches by 24 inches, all glazed

with sheet glass $\frac{1}{8}$ inch thick, each strip in one piece, and the openings inside to be properly finished.

Bond-wood.—Bond-wood 4 inches by 1 inch shall be provided by the contractor, and placed into its position 20 inches from centre to centre by the mason. The whole walls, except coal place, to be strapped with $1\frac{1}{4}$ inches by 1 inch straps, nailed to the bond-wood.

Partitions.—The partition posts shall be 4 inches by 2 inches, placed at 18 inches from centres. Door-posts and lintels in partitions to be 6 inches by 3 inches, checked for lath and plaster, and in stone walls the door-posts to be 5 inches by $2\frac{1}{2}$ inches, fixed with split bats.

Stair.—The stair to be properly bracketed up with strong strings and intermediate bearer 6 inches by $2\frac{1}{2}$ inches, with rough brackets, the risers to be 1 inch thick, and treads $1\frac{5}{8}$ inches thick, with nosing. The balusters to be of cast-iron, a specimen standard to be submitted for approval, two to be fixed on each tread, and those on landing to be the same distance apart. The coping to be of best pitch pine $2\frac{1}{2}$ inches by 3 inches, and to have a proper twist and scroll.

Floors and skirtings.—All wood floors to be laid with $1\frac{1}{8}$-inch dressed and ploughed flooring, securely nailed and cleared off. The whole of the upper floors to be prepared for deafening with fillets nailed to the joists 1 inch square, and resting on these fillets $\frac{5}{8}$-inch ragdeals properly split, and the floors to be trimmed with trimmers 8 inches by $1\frac{1}{2}$ inches. All walls to be finished with skirting $1\frac{5}{8}$ inches thick and 7 inches deep.

Windows.—The windows shall be sash windows, having pulley-pieces of 1-inch deals, outer and inner facings $1\frac{1}{4}$-inch deals, sashes to be $2\frac{1}{8}$ inches thick, with hooked counter checks, double hung with patent cord or zinc chain over brass-faced pulleys 2 inches in diameter, and metal weights. Windows to have brass spring sash fasteners, lifters, and pull-down eyes. The sides, dados, and soffits of windows on ground floor to be plain lined, and finished with facings set on blocks. The angles of the sides of windows on ground floor to have 4 inches moulded facings $\frac{3}{4}$-inch thick. All windows and fanlights to be primed and glazed with 26 oz. sheet glass, and lobby door to have upper panels of obscure sheet glass 32 oz., all securely fixed with oil putty. Angles for which no finishing is specified to have $1\frac{3}{4}$-inch staff beads.

Doors.—Front entrance door to be framed and panelled $2\frac{1}{4}$ inches thick, with inch panels moulded on both sides, and hung

with three 6-inch double-jointed edge hinges, and to have an 8-inch cased lock and solid brass furniture, with proper stops and facings. The transom bar to be moulded, and the fanlight properly framed. The back entrance door to have side styles and top rail 2 inches thick, bottom and intermediate rails 1¼ inches thick, lined with ¾-inch dressed and ploughed lining, and to have 8-inch case lock and brass furniture hung with three 6-inch double-jointed hinges, and to have proper stops and facings, transom bar to be moulded, and fanlight framed. Doors of sitting-room, parlour, and lobby to be framed 1¾ inches thick, plain panels ¾ inch thick and moulded, and to be finished with facings same as windows. Bedroom, and other inside doors, to be 1½ inches thick, framed and panelled with ½-inch thick panels, and moulded on both sides 4 inches broad and ¾ inch thick, and to have facings corresponding to the windows. Press doors to match the room doors, and to have 1s. 6d. press locks and sham furniture. The sitting-room, parlour, and bedroom doors to have 6-inch mortise locks and satin-wood furniture, and case locks for all others with brass furnishings, all to be hung with 6-inch double-jointed edge hinges, and to have ⅝-inch stops.

Mantelpieces and Shelving.—Parlour, sitting-room, and bedrooms to have neat wooden mantelpieces as shall be directed by the inspector, and the kitchen fireplace to have a shelf 1½ inches thick batted into the lintel; 36 superficial feet of shelving for kitchen, and 40 superficial feet of shelving for pantry of 1-inch boards, dressed and ploughed, shall be fitted up where shown, supported on cast-iron brackets. Presses to be lined with ½-inch dressed and ploughed deal, those in bedrooms to have one shelf and four wardrobe hooks, and all other presses to have four shelves each of 1-inch deals.

Sink and Water-Closet.—The sink in kitchen to be supported on proper framing, lined around and in front with ½-inch dressed, ploughed, and beaded lining, part being made portable, hinged with small hinges and fixed with button snecks; and the top of sink table to be 1 inch thick. The front ends of water-closet to be covered with frames 1½ inches thick, and panelled, the front being portable. The seat and lid to be of same thickness, panelled, beaded, and flushed, and hinged with two brass hinges. Partitions in coal place to be lined with ⅝-inch boards.

Painting.—All outside wood and iron work to receive four coats of good oil paint, to be finished to a colour selected by the employer.

All carpenter work required by plumbers or bellhangers to be provided. The window glass and all the interior of the house to be left clean at completion, and all work in connection with this department to be finished in a tradesman-like manner, and left complete, in accordance with the foregoing specification, general conditions, and plans to which they refer.

(*See General Conditions.*)

Slater Work.

The roof lights shall be provided by the carpenter, but securely fixed into the proper places by the slater.

The roofs, including roof of porch and roofs and sides of windows, shall be covered with best dark blue Port Dinorwick slates, 16 inches by 10 inches, and not less than $\frac{3}{8}$ inch thick. The slating to be put on with an average cover of $2\frac{1}{2}$ inches, each slate double-nailed with 12-lb. nails (dipped in oil when red-hot), and the slating to be fair and securely laid, and well shouldered with haired plaster. The ridges to be covered with fireclay ridge tiles, with 7-inch wings, bedded on cement, and carefully jointed and pointed with the same. The skews, raggles, and chimney-heads to be carefully pointed with cement, and the whole made weather-proof, and finished in a tradesman-like manner, according to the foregoing specification, general conditions, and plans to which they refer.

(*See General Conditions.*)

Plumber Work.

The roof lead shall weigh 6 lbs. per square foot; sill-pieces of skylights to be 14 inches broad, turned up inside. Angle-pieces of roof windows, chimney necks, etc., 10 inches broad, grooved into the stone. The rhones to be of cast-iron, half round, 5 inches in diameter, supported on malleable-iron straps $1\frac{1}{4}$ inches by $\frac{1}{4}$ inch, securely screwed to sarking. The down pipes shall be round, of cast-iron, 3 inches in diameter, and secured to the walls with iron crampets; to have rain-water heads at top, with proper covers, and shoes at bottom, and to discharge on fireclay basins with iron gratings, having sufficient sand-traps connected with the drains.

Waste-pipes.—The soil-pipe to be of 6-lb. lead, 5 inches in diameter, carried 2 feet through the walls, and joined to a "Buchan's trap" with air-grating over it. The upper end of soil-pipe to be carried through the roof, and finished with an air-pump ventilator

(Boyle's). The waste-pipe from sink to be trapped, having a proper overflow pipe connected with drain outside by a "Buchan's trap."

Sink.—The sink to be of galvanised cast-iron, 18 inches by 24 inches by 10 inches; to have all necessary fittings, including plug, socket, and chain, with overflow pipe, properly trapped.

Water-Closet.—The water-closet to be Shank's patent closet No. 1, with 3-gallon patent reliable cistern, complete with brass fittings.

Water Supply.—The main water supply-pipe to be of lead, $\frac{3}{4}$-inch bore, 7 lbs. per yard, sunk 18 inches in the ground and properly covered, and carried up to cistern and securely connected. The branches to sink and water-closet to be $\frac{3}{4}$-inch diameter, and sink branch to be finished with $\frac{3}{4}$-inch brass nose cock.

Bellhanging.—The bells to be hung on a board in the kitchen, and to weigh from 10 to 12 oz. each, and to have proper springs and carriages. The wire to be of copper No. 16, B.W. gauge, conveyed in zinc tubes behind lath and plaster or under floors at angles; to have small brass pulleys and chains, the wires to be conveyed to sitting-room, parlour, and three bedrooms on upper floor, and front entrance door.

The front entrance to have a 4-inch octagon bronze pull-sneck in the door rybat. The sitting-room and parlour to have each a pair of levers, value 7s. 6d., and bedroom levers to be of the value of 3s.; all pulls to match the door furniture.

All work to be completed in a tradesman-like manner, according to the foregoing specification, general conditions, and plans to which they refer.

(*See General Conditions.*)

Plaster Work.

The whole ceilings, partitions on both sides, stone walls where strapped, window sides, dados, and soffits, where not lined with wood, stair backs, etc., to be lathed with sawn and split fir lath, $\frac{3}{8}$ inch, put on with cast lath nails. The whole thereafter to receive three coats of plaster, the first two coats prepared with one part lime to two and one-fourth parts clean sharp sand, and one-sixth part hair, and to be finished with a coat of fine stuff, all properly straighted, hand-floated, hand-finished, and smoothed.

The whole of the upper floors to be deafened from wall to wall; to have first a coat of hair-plaster, filled in above with smithy ashes, and finished with a coat of plaster, the whole being at least $2\frac{1}{2}$

inches thick. All window cases to be bedded in lime, and pointed with cement outside.

The spaces behind all skirting to be lathed and plastered close down to the floor. The sitting-room, parlour, and front entrance passage shall be finished with 18-inch cornices, according to drawings to be supplied by the inspector; and the whole to be finished in a neat, tradesman-like manner, according to the foregoing specification, general conditions, and plans to which they refer.

(*See General Conditions.*)

General Conditions.

1. Contractors shall provide all materials (except such materials as are otherwise expressly specified in the foregoing specifications), and provide scaffolding, tools, etc., and bear every other expense necessary to complete the works, in terms of the foregoing specifications, these presents, and the plans to which they refer; and offers for each department of the work to include all such expense.

2. Whatever is shown on the plans shall be considered as both shown and specified; and whatever is specified shall be considered as both specified and shown.

3. The employer reserves full power to alter or vary the foregoing specifications and plans as he may think fit during the progress of the works. The increase or deduction on the contract price in consequence of such alterations or variations shall either be settled by contract before being proceeded with, or be made at a valuation fixed by the inspector of works. No extras shall be allowed unless sanctioned by the inspector of works in writing, at prices agreed upon.

4. The inspector shall have full power to reject all work or materials not in strict conformity with the plans and specifications, or in his opinion not fit to be used in the works; and should the contractor, after due notice has been given him, fail to remove any such work or materials, or fail to carry on the work satisfactorily and expeditiously, so as to ensure its completion by the stipulated time, the inspector, on behalf of the employer, shall have full power, under reservations of all claims of damages against the contractor for breach of contract, to remove such work or materials, and carry on and finish the work at the contractor's expense, and the contractor shall not be entitled to interfere with or molest those employed by the inspector to complete the works.

5. In the event of any difference of opinion arising as to the true meaning or intent of any part of the plans or specifications, or as to the value of any work or material, the same shall be determined by two arbiters, of whom one shall be chosen by the employer, and the other by the contractor, with power to the arbiters to name an oversman in the event of their differing in opinion.

6. Payments shall be made as the work progresses to the extent of 75 per cent. of the value of the work executed, as shall be determined by the inspector, and the balance shall be paid when the work is completed and taken off the contractor's hands by the inspector.

7. The contractor for mason work shall be bound to commence work on the day of , and carry on the same so as to have the walls ready for the roof before the day of , and the whole contract finished by the day of thereafter. The contractor for carpenter work shall commence roofing as soon as the walls are ready for the roof, and shall have the whole roofing finished within twelve days thereafter, and carry on his department of the work so as to have the whole completed by the day of . The contractors for plumber and slater works shall commence the roofing operations immediately the sarking is finished, and shall have the whole roofs finished within ten days thereafter, and both shall have their contracts finished by the day of . The contractor for plaster work shall commence his department whenever the walls are strapped, and have his contract completed by the day of .

8. The whole and every department of the afore-described works shall be finished in a neat, substantial, and workman-like manner, and the plans completed to the satisfaction of the inspector of works, notwithstanding that any necessary parts of the same may not have been particularly specified or noticed in the foregoing.

XVII. *On the Rearing and Management of Hardwood Plantations.*

By A. M'D. Grant, Assistant Forester, Hopetoun, South Queensferry.

The rearing and management of hardwood plantations is one of the most important branches of Forestry. It has been ably and extensively treated by some of the most eminent arboriculturists of the day. The subject is, however, by no means exhausted. To be properly understood, it requires not only diversified experience, but careful study as well. On the treatment which plantations receive from time to time, depends, to a very great extent, the success of the undertaking both from a utilitarian and æsthetic point of view. The forester may, in fact, be said to hold the future welfare of a plantation in his hands. If, for instance, a mistake be made in the methods of planting adopted; if the distribution of the trees be not properly carried out; if the draining of the ground be injudiciously executed; or if indiscriminate pruning or thinning be indulged in, the desired ends will never be attained, the result being that the planter must suffer not only disappointment, but discouragement and loss to boot. In laying out a plantation, the first considerations to be attended to are, the nature of the soil, altitude, exposure, the manner in which the produce to be raised is to be got out of the plantation, and the particular object the plantation itself is to serve. If these points be kept in view, and if the after management be properly carried forward, there is no reason why the labours of those concerned should not be crowned with success.

Hardwood plantations may be said to include those grown for scenic effect, and those for profit alone. In my opinion, however, some attention can always be paid to the landscape effect without interfering with the value of the plantation, or incurring much expense on its cultivation. The circumstances and views of the proprietor have, of course, a good deal to do with this. In most cases, however, there is generally some pains taken to enhance the beauty of the landscape, but everybody is, I should say, alive to the fact that profit is the paramount object to be attained.

In treating the subject under consideration, I shall, in the meantime, endeavour to point out a course of treatment which may reasonably be expected to produce satisfactory results, both from a pecuniary and an æsthetic point of view, bearing in mind, however, that profit comes first.

Fencing.—There are so many excellent systems of fencing that it would be invidious to recommend one kind more than another. At all events, the site of a plantation should always be securely fenced, and, where ground game is plentiful, every possible means should be resorted to for keeping *them* from making inroads on the plants, as nothing could possibly retard their growth more than the attacks of hares and rabbits. It will be found cheaper, in the long run, to erect a proper fence at first, for the simple reason that the patching up of an inferior one is, in nine cases out of ten, simply throwing away money for no good result.

Draining.—Drains should always be scored off previous to commencing planting operations. It is not, however, necessary to have them opened until afterwards. Though a good system of drainage is absolutely necessary to the welfare of a plantation—nay, contributes considerably to its financial success,—it must often be limited to what is *really necessary*, for the simple reason that the making and keeping of ditches increase considerably the expense of a plantation. It must also be observed that over-draining would be disastrous in its results. In some instances little or no drainage is required, in others it cannot be dispensed with. The "herring-bone" system, which is very commonly adopted, is by no means to be commended, because it impedes cart-traffic, dragging wood, etc., etc. This system may, however, be adopted with propriety when the ground is marshy. The state of the soil has a good deal to do with the size of the drains. From 3 to 3½ feet wide and 2 to 2½ feet deep are the general dimensions. By looking over the drains occasionally, it can easily be seen when they require to be "scoured" out—a very necessary proceeding which must not be overlooked.

Planting.—There are two distinct methods of planting, viz., pitting and notching. Pitting is admitted on all hands to be the most preferable for, at least, all hardwood plants. Notching can, however, be adopted with propriety in planting moorland with conifers. At the age at which foresters generally approve of planting out hardwoods, considerable benefit is derived from the making of large roomy pits, so that the roots of the plant be allowed to be set in their natural position, and covered up and firmed with soft earth. It will thus the more readily strike out young fibrous roots, and be enabled to develop itself the more quickly.

The size of the holes should never be less than 14 inches square,

so that the planter may have every opportunity of firming the plant thoroughly, so as to keep it safely in its position. If this be not carefully attended to, the plants are easily shaken about by the winds, which process often causes them considerable damage. The pits should be filled in on the same day as they are dug. Some foresters prefer digging all the pits first, and filling them in afterwards. I do not approve of this system, for the reason that the holes, by being left open, often get filled with water, especially if the season be a wet one. It also impedes the planting operations in several ways, which I need not define, and this incurs unnecessary expense.

Every means should be adopted to keep down rank grass and weeds. The first and most obvious indication as to treatment in this respect is to put the turf cut off in the bottom of the pit instead of on the top, as is generally done. Another method is to cut the turf in two, and place it upside down. Sometimes, however, grass, notwithstanding the efforts that are made to keep it down, grows very quickly, and every possible precaution to prevent it from obstructing the plants should be resorted to; for unless the plants are allowed a sufficiency of light and air, the process of assimilation of sap cannot go on. In order to make my meaning clear, I shall endeavour to give a brief explanation as to what this really means. The elements which enter the leaf are oxygen and hydrogen in the form of water, with some earthy matters dissolved in it. These constitute what is called crude sap. Then the process of *assimilation* begins. The agents in this are the green colouring matter of the leaf and the sun's rays. The crude sap is blended with the carbonic acid gas of the atmosphere, and the overplus of oxygen is separated and sent back again into the air. Thus a mixture is formed called *elaborated sap*, which is then transformed into cellulose, and passing down the plant, is gradually used up in the formation of new cells.

Distribution.—If the number of men employed in the planting operations be not very large, the distribution should be left to one or two reliable men. Whether the different kinds of plants be laid out singly or in groups, is, to a great extent, a matter of taste. I am, however, inclined to think that the grouping system has, if anything, the advantage over the other, inasmuch that it leaves us a double chance of distributing the plants on the soil best adapted to their growth; and further, by planting in groups the arrangement of colour can be better preserved when thin-

ning the plantation. If, for instance, a tree of one kind be cut, more room is probably made for one of the same kind, the result being that if ultimately only one tree of the group be left, that tree will probably cover as much ground as the whole group originally did, thus leaving the colour arrangement as good as ever. To discuss these points to their full extent is, however, slightly beyond the province of this paper.

Nursing.—Various systems of nursing are in practice. The one most commonly adopted, and undoubtedly the best for exposed situations, is to fill up the spaces between the hardwoods with conifers, planted 4 feet apart. As the nurses in question grow much quicker than the hardwoods, they require to be a good deal smaller, otherwise they soon begin to intrude on their neighbours (thus depriving them of light and air), and have to be cut down. In less exposed situations, and where coppice wood is in demand, the remaining spaces are filled up with plane, ash, birch, some species of dogwood, and the like. This sometimes proves itself to be an excellent plan, especially in localities where there is a good demand for props, bobbin-wood, crate-wood, and such like. When in its earlier stages, birch will be found very useful for many purposes. All the kinds, in fact, which we have mentioned may be utilised at whatever time it is considered necessary to cut them. Coppice may, indeed, be grown during the whole period of the standard crop's growth without materially affecting it. Both these methods I have just described can be adopted with propriety according to attendant circumstances, such as soil, locality, etc. Special care should be taken to shield a plantation on the side most exposed to the prevailing winds. This is best accomplished by protecting the part or parts in question with a "belt" of good-sized conifers.

In the vicinity of pleasure-grounds a different method—that of nursing with yews—is resorted to. This system cannot be recommended from a utilitarian point of view, but where it is desirable to retain intact the beauties of the pleasure-ground, there is nothing to equal it. This system is specially adapted for woods in the immediate vicinity of the mansion. If skilfully and tastefully laid out, and intersected with rides and walks, it may be made to appear a continuation of the pleasure-grounds. We thus avoid the too abrupt termination—which is so hurtful to the eye—of ornamental spaces, and at the same time derive at least some recompense for our labour. Cypress, arbor-vitæ, holly, and

rhododendron are also brought into requisition under the head we have just been considering. Picked plants—large, shapely, and well-developed plants—should be kept for this purpose, and the best of them put next the walks, or the parts where they are most likely to be in view. It is a common thing to grow good poplars, planted at from 5 to 6 feet apart, in partially sheltered situations without nurses.

Pruning.—This is a most important branch of forestry, but one which is, unfortunately, very often neglected. The main point in this case is to begin in time. If a plantation be allowed to attain a certain age before pruning is commenced, it certainly does more harm than good. Wholesale pruning of a tree twenty or twenty-five years of age, for instance, is very apt to badly injure it; hence the reason why so many experienced men are averse to pruning. If it be intended to do justice to a plantation in this respect, we must begin with the pocket-knife and hand-saw two or three years after planting, and continue using them at regular intervals up to, say, the twenty-fifth year.

In commencing pruning operations, the main object to be kept in view is to regulate the growth of the tree by keeping the number of superfluous branches in check, and the undue development of others, so that the greatest quantity of timber may be secured without being intruded upon by the production of strong branches. Pruning, when resorted to in time and continued at necessary intervals, is an operation which does not cost so very much, and which is, at the same time, beneficial in a high degree to the trees. If, on the other hand, this highly-important operation be neglected, a great number of the trees will have grown into bushes, which in turn will become distorted into every shape imaginable. If pruning be resorted to at all in such cases, it must be executed in a very judicious manner. To, as it were, force such trees into a symmetrical appearance, by stripping the trunk of branches to a certain height, and by shortening those left indiscriminately, the result would be that the tree would die in a short time, or never, at least, recover from the sudden shock. When such an operation is performed in winter, if the tree should survive, the consequence will be that the sudden check on the flow of sap will cause numerous small-spray, known under the name of "breast-wood," to spring out all over the stem and branches. The woody deposit, which would otherwise have gone to enlarge the stem, would thus be reduced to a minimum. In

any case, the repetition of a similar process would ruin the trees entirely. The fact of the matter is, that if the trees survive such treatment at all, they merely drag out a miserable existence at best, and are entirely ruined for the purpose they were intended to serve. The experienced pruner will, however, act very differently. He will commence in time, and reduce the branches gradually, so that the result aimed at may be brought about by degrees—the operations, in fact, extending over a number of years.

The lower branches should be left untouched on the trees lining the outside of a plantation, and this helps, through time, to hide the stems entirely from view. Any branches which seem, however, to develop themselves too quickly must be shortened at points where smaller ones spring from them, so as to force them into uniformity with their neighbours. Trees having more than one leader must have the central and most vigorous one left for its future top. The others must be removed close to the stem, or further up, if considered necessary, but in any case close to a lateral shoot.

The hardwoods inside the plantation will require to be treated somewhat differently. All the lower branches will have to be gradually cut away, so that about one-third of the entire stem be left clean. Great care should be taken to cut the branches off neatly, and as close to the stem as possible. The wound should also be made smooth with a sharp knife or hand-bill. The top, if double, should be regulated in favour of the best contending leader; and side branches, when developing themselves too quickly, should be shortened at an offshoot springing from them at any convenient point. A good few trees will, in all probability, not require to be touched at all, while others may only require a branch to be shortened here and there.

In order that all exudation of sap will have ceased, and that the wounds be partly healed up before the end of autumn, all the pruning possible should be done in July and August. The sap does, moreover, not flow so readily from a recently wounded tree in those months.

Pruning should not be resorted to immediately before or after thinning, but should precede that operation by at least one year. The trees will thus be enabled to recover from any slight change which may have been caused by the operation. They will also be better able to withstand any difference of temperature which may be occasioned when thinning takes place.

In removing broken, dead, or decaying limbs, great care should be taken not to damage the trees in any way by splitting or tearing the bark. In order to obviate this, heavy limbs should be cut off piece by piece.

Thinning.—On the manner in which this part of wood management is carried out, depends, to a very great extent, the ultimate success of the undertaking both from a utilitarian and æsthetic point of view. Attendant circumstances must entirely guide the operation in this case. The time for thinning will depend very much on the progress the plantation has made; in consequence of which no definite rule can be laid down for the carrying forward of this part of the work. The fact, however, that all the plantation will not be ready for thinning at the same time, may be taken for granted. The lower and less exposed parts will be ready for thinning some four or five years before the higher and more exposed. At all events, whenever it is found that the nurses are commencing to encroach on the hardwoods, thinning should at once commence by removing them. This does not, of course, imply that all the nurses are to be removed at once. It cannot, indeed, by any means be recommended to give the standards too much play all on a sudden. Sufficient relief can be given in some cases by removing the branches of the nurses, but after a time it will be necessary to take out one here and there, in order that the desired end may be attained. In cases where the trees have become one-sided, it will be found necessary to give greater space on the side opposite to that on which they have spread. By following this plan the branches will generally shoot out in that direction, and thus equalise their tops. In order that the side branches may have an opportunity of fully developing themselves, the lines of trees skirting the outside of a plantation should be thinned the more freely. This line of action will also have a tendency to strengthen their roots, and thus enable them better to resist gales of wind. A sufficiency of light and air should always be admitted, so that the trees may grow proportionately. Sycamore and ash may be grown more closely than other varieties, the reason being that they are less subject to throw out strong side branches.

Less freedom must be allowed when thinning the higher parts of a plantation. The reason is obvious. Light and air may be admitted longer on slopes, and especially on the lower side of the plants, than on flatter grounds; and further, if the trees be

allowed too much room, they will, owing to their elevated position and the influence of other external agencies, form flat tops and probably dwarfed stems.

In after years thinning may be resorted to whenever it is found that the nurses are encroaching on the standards. It will sometimes be found necessary to give trees which have attained to a proper and compact form more room than they received on previous thinnings, so that they may be enabled to form shapely and widespread tops. It would, for instance, interfere considerably with the scenic effect of a plantation if bare limbs or parts of the trunks of some trees appeared above the tops of the others. After all the nurses have been removed, the plantation should stretch out before the eye in every direction, presenting an undulating-like surface of many colours—natural in all its aspects, and with nothing to mar the beauty of the picture.

At what period of the plantation's growth *all* the nurses will be removed, depends entirely on the progress the plantation has made; but it may be taken for granted, at least in most cases, that the standards will derive little or no benefit from the nurses after the twentieth or twenty-fifth year.

In felling the nurse trees, great care should be taken not to damage the standards. In order to successfully accomplish this, it will, in most cases, be found necessary to divest them of their branches before they are felled. This process is known to practical men under the name of "lopping." As many of the trees in question as possible should be carried out by men, because it is often highly injurious to the roots of the standards to employ horses for the purpose of dragging them out.

It is absolutely impossible to lay down a definite scale as to the distances which should separate the permanent standards. From 20 to 30 feet is the general thing counted upon; but altitude, exposure, and other matters have, of course, a vast deal to do with this. With the exception of taking out really bad trees, regularity should certainly receive special attention.

In cases where some consideration is given to the rearing of game, all indigenous undergrowth should be encouraged. By repeatedly cutting back such species as briers, hazel, and blackthorn, a thick and vigorous growth will be the result. The sides of rides and other conspicuous points throughout the plantation, should be filled in with laurels, rhododendrons, cotoneasters, barberry, yew, box, privet, and mahonia. By fixing down the

privet with wooden pegs, a thick undergrowth may soon be acquired.

The only pecuniary returns hitherto realised have been from thinnings; but though some sacrifices may have been made, it will be found that the wood remaining on the ground is now worth a considerable amount of money; and, indeed, the presence of such a plantation on an estate will tend to enhance its value in more ways than one.

Felling.—Felling should in general be done with the saw, because this instrument makes neater work and wastes less wood than the axe. The best time for felling is from September to March, inclusive. Small trees may be felled with the axe, and also large ones when it is desirable to have them cut very low. By sinking the stock towards the centre, the rain will have a tendency to lodge in the cavity thus formed, and thus hasten the decomposition of the root. When it is intended to encourage the growth of coppice, the stock should be elevated towards the centre, so that it may be better able to resist the influence of rain, and thus preserve it from rot.

In cases where the bark is preserved, the trees should be felled in sunny weather, about the beginning of summer, and kept as much as possible in the shade, so as to protect them from the sun, which, by the way, encourages splitting to an alarming degree.

Lotting.—In the event of the wood cut being lotted for sale, the trees should be carefully sized, and the lots neatly put together. Where a number of lots come together, they should be kept as nearly as possible in line. This process does not present any great difficulty to practical men who have been accustomed to such work, and it makes the wood have a better appearance. Wood is often drawn and huddled together in a manner which does not reflect much credit on those concerned in the operation. This probably arises from the prevalent notion that this part of forestry does not require much attention. This is, however, a mistaken idea altogether. If the wood for sale be properly "sized," and put up in neat and compact lots, not only the disposer, but the purchaser as well, will be better able to form a more accurate idea as to the approximate value of the wood before him.

XVIII. *Economic Forestry.* By Professor G. S. Boulger, London.

Introduction.

The most scientific department of the art of forestry is undoubtedly the maintenance and reproduction of woodland for purposes of profit. In spite of the enormously extended use of iron for purposes of construction, and of purely chemical substances for tanning, dyeing, etc., the products of the forest meet us at every turn, no matter in what quarter of the globe, or amid what race of men, we may find ourselves. In our northern temperate latitudes timber, bark, charcoal, and coniferous resins are the main staple of the forester; but within the tropics a multiplicity of other substances—dyes, gums, and food-stuffs—become of an importance, economically speaking, hardly second to that of the timber, and the forest-conservator may often be as much interested in the preservation of a mere shrub, as in that of the largest tree. Considerations of space, however, enforce the limitation of the present essay to the subject of timber-trees, though their subsidiary products have been noted *en passant.*

The importance of a "stock-taking" of the timber-resources of the world will be generally conceded. An acquaintance with the valuable trees of any country will be an important step, both towards their preservation from wanton extermination, and towards their introduction into other countries, which may happen to be under similar climatic conditions. Such an acquaintance it is, however, unfortunately, by no means easy to obtain. Timber is too often obtained from the less known or accessible parts of countries, but partially explored by skilled botanists; whilst it is brought to the port of shipment without flowers, fruit, leaves, or even bark and sapwood, and under native names which often serve only to mislead. When we note the extreme ignorance often manifested as to trees, their names and natures, even by dwellers in the country, among the civilised communities of Europe, we cannot be surprised if Burmese convicts in the Andaman Islands, Australian natives, or the half-savage Indians of Guiana make mistakes as to the identity of species. It is much to be desired that the governments of every country should take steps for the botanical identification of their various vegetable productions. With regard to trees the system required is that logs of each

species should be prepared with the bark on—at least partly,—cut in various directions—say radially, tangentially, transversely, and obliquely;—and that these be carefully numbered and named with incised letters, and be accompanied by specimens of leaves, flowers, fruit, and seeds. It has long been a common custom to preserve such specimens in book-like cases made from the woods themselves; and the method, exhibited in the Japanese section of the Edinburgh Forestry Exhibition, followed by New Brunswick in the Colonial and Indian Exhibition, of painting a detailed representation of each species on a panel of its own wood, framed in its own bark and branches, is also well worthy of imitation. Such specimens can be readily determined botanically, and should be multiplied both for educational use in forest, and other schools, at home, and to acquaint foreign nations with the products of the country.

For the purposes of the present essay the collections of timber, etc., at the Edinburgh Exhibition of 1884, at the Royal Gardens, Kew, at the British Museum, and at the Colonial and Indian Exhibition, London, 1886, have been systematically examined; but in not a few cases the neglect of the means above mentioned has entirely prevented the botanical identification of valuable species.

The plan here followed is mainly geographical, this having been found most convenient as being adopted in all the above-named collections, and in Dr Cleghorn's article on "Forests and Forest Administration" in the *Encyclopædia Britannica* (9th edition, vol. ix., pp. 397-408), to which the present writer is deeply indebted on this, as on former occasions, both for much substantive information, and for many useful bibliographical references. The numerous other books consulted are mostly mentioned under each country; but special acknowledgment must be made here to Loudon's "Arboretum et Fruticetum Britannicum," 8 vols., London, 1838; Mr Thomas Laslett's "Timber and Timber-trees," London, 1875; Mr Julian Rogers' Analysis of Returns . . . relating to Colonial Timber, presented to Parliament, 1878 [C.—2197]; Reports respecting . . . Timber in Foreign Countries, presented in 1875 [C.—1161]; Reports by H.M.'s representatives abroad on . . . Woods and Forests, presented in 1884 [C.—4048]; the Official Guides to the Royal Botanic Gardens and the Museums of Economic Botany at Kew, London, 1885 and 1886; Herr Nordlinger's "Holzquerschnitte," Stuttgart, 1862-82; the *Journal of Forestry* (afterwards "Forestry"), vols. i.–xi., 1877-1885; and to "Forestry and Forest Products," Edinburgh, 1885. In none of

these books, however, is there so full a list of timber trees, and their vernacular names, as that in the present essay.

EUROPE.

Most of the forest trees of Europe are familiar to us either in a wild or cultivated condition, the British Isles having no species which do not occur on the Continent. The following table gives the acreage of woods and forests in the various countries of Europe from about 1875 to 1877 :—

	Acres.		Acres.
Great Britain, . .	2,187,078	Würtemberg, . .	1,494,147
Ireland, . . .	328,413	Holland, . . .	486,229
United Kingdom, . .	2,515,491	Belgium, . . .	1,073,452
Russia, . . .	527,426,510	France, . . .	20,641,953
Sweden, . . .	40,636,883	Italy, ...	9,031,310
Norway, . . .	17,290,000	Austria, . . .	23,284,174
Denmark, . . .	364,474	Hungary, . . .	19,425,600
North Germany, . .	20,047,014	Switzerland, . .	1,905,407
Baden, . . .	1,337,767		

UNITED KINGDOM.

The forest area is thus distributed :—

	Acres.		Acres.
England, . . .	1,325,765	Wales, ...	126,823
Scotland, . . .	734,490	Isle of Man and the Channel Islands, . .	3,240
Ireland, . . .	325,173		

In the north of Scotland the prevalent indigenous species are *Pinus sylvestris*, L., the Scots fir, and *Betula alba*, L., the birch; but much of the pine is planted, and there are extensive plantations of larch (*Larix europæa*, DC.), *e.g.*, the Duke of Atholl's 10,000 acres at Dunkeld. At Rothiemurchus, Inverness, where the Scots fir is indigenous, the trees have an average height of 70 feet and a girth of 4½ feet. With reference to this species it is worthy of note that, on the Continent at least, it is very variable, no less than fourteen forms having been described from Savoy alone, and as these forms are of slightly different value as timber, it is important to discriminate them with a view to cultivate the best. M. Vilmorin divides them into two groups—(1.) *rubra*, with ascending, and (2.) *vulgaris*, with horizontal, branches. To the latter belong the Geneva and Briançon pines; and to the former the Hagenau or German, the Scots, the Louvain, and the Riga varieties. To the last named, the most valuable type, belongs the timber from Smolensk, Vitebsk,

Tchernigov, and Volhynia. In the south of Scotland the beech (*Fagus sylvatica*, L.) and ash (*Fraxinus excelsior*, L.) are the most common trees; whilst the sycamore maple, locally known as "Plane" (*Acer Pseudo-platanus*, L.), is also abundant. The ash reaches 30 or 50 feet in height, with a diameter of from 20 to 24 inches, and is useful for tool handles, coopers' work, crates, and many other purposes (nat. order, *Oleacea*). The sycamore (nat. order, *Aceracea*) reaches from 30 to 80 feet, and is used for cider-presses, rollers for calico printing, musical instruments, especially violins, toys, butter-moulds, etc.

In England, whilst there are extensive coniferous plantations, mainly larch and Scots pine, the most prevalent trees are oaks and beech. The oak (*Quercus Robur*, L.; nat. order, *Cupulifera*) forms a trunk from 60 to 100 feet high, and is one of the strongest and most durable of woods for furniture and building purposes. It was formerly much more used in ship-building, and its bark is still in considerable demand for tanning. Two forms are well marked—*Quercus pedunculata*, Ehrh., and *Q. sessiliflora*, Salisb. The beech (*Fagus sylvatica*, L.), belonging to the same order, reaches 60 or 70 feet in height, and 40 to 50 inches in diameter. Its wood affords excellent fuel, and the best charcoal for most purposes; and is also used for wedges, the best planes, tool-handles, and other turnery; for piles; on the Continent for shoes; and more especially for chair making, for which purpose it is grown on the chalk hills of Buckinghamshire, near High Wycombe, from 12,000 to 15,000 loads being used yearly.

Other British trees are the following:—The linden or lime (*Tilia europæa*, L.; nat. order, *Tiliacea*), the inner bark of which is "Russia matting," whilst the close-grained but soft wood is pre-eminently adapted for carving, and for the sounding boards of pianos; the spindle-tree (*Euonymus europæus*, L.; nat. order, *Celastracea*), formerly used for skewers, and to some extent for gunpowder charcoal; the buckthorn (*Rhamnus catharticus*, L.; nat. order, *Rhamnacea*), whose berries yield the pigment "sapgreen;" and the alder buckthorn, or berry-bearing alder (*R. Frangula*, L.), which under the name "dogwood" furnishes the best charcoal for making gunpowder, and is imported for this purpose from Holland and Belgium; the horse-chestnut (*Æsculus Hippocastanum*, L.; nat. order, *Sapindacea*), an ornamental tree, truly a native of Northern Greece; the maple (*Acer campestre*, L.), of the same order, a small tree 10 to 20 feet high, with fine and even-grained wood, affording

good charcoal, and formerly used for bowls known as "mazer-bowls," spoons, etc.; the sloe or blackthorn (*Prunus communis*, Huds.; nat. order, *Rosaceæ*), used for walking-sticks; the apple (*Pyrus Malus*, L.) and pear (*P. communis*, L.), valuable fruit-trees when cultivated, both having close and even-grained wood, that of the latter being used for T squares, etc.; the rowan, or mountain ash (*P. Aucuparia*, Gaert.), a valuable nurse tree; the wild service (*P. torminalis*, Ehr.), and the hawthorn (*Cratægus Oxyacantha*, L.), the wood of which is one of the best substitutes for boxwood for engraving, all belonging to the same order; the box (*Buxus sempervirens*, L.; nat. order, *Buxineæ*), as yet unequalled for engraving, growing only in a few localities on limestone hills, and mainly imported from Russia and Persia; the elms (*Ulmus campestris*, With.; nat. order, *Ulmaceæ*), in the south of England, and the Wych elms (*U. montana*, Sm.), north of the Trent, much used for coffins, and formerly for water-pipes, reaching 100 or 120 feet in height, and more than 3 feet in diameter; the alder (*Alnus glutinosa*, L.; nat. order, *Betulaceæ*), from 20 to even 70 feet high, and 8 to 16 inches in diameter, the wood of which is used for gunpowder charcoal, clogs, and packing-cases, and the bark in tanning; the hornbeam (*Carpinus Betulus*, L.; nat. order, *Corylaceæ*), extremely hard, used for cog-wheels, bench-screws, mallets, boot-lasts, etc., sometimes reaching 70 feet in height and from 10 to 15 inches in diameter; the hazel (*Corylus Avellana*, L.); the holly (*Ilex Aquifolium*, L.; nat. order, *Ilicineæ*), 20 to 30 feet high, used for calico-printers' blocks, "stringing" in inlaying, Tunbridge ware, mathematical instruments, etc., "bird-lime" being prepared from the bark; willows, especially *Salix alba*, L., *S. fragilis*, L., and *S. Russelliana*, Sm. (nat. order, *Salicaceæ*), light and tough woods, used for gunpowder charcoal and for various other purposes; poplars, especially the aspen (*Populus tremula*, L.), which affords a valuable paper-pulp; and the yew (*Taxus baccata*, L.; nat. order, *Taxineæ*), formerly used for bows.

Among commonly cultivated exotic trees may be named *Robinia Pseudacacia*, L., a North American leguminous tree, used for shafts, known as "locust," or "acacia;" the laburnum (*Cytisus Laburnum*, L.), in the same order, a beautiful tree with a handsome wood; the planes (*Platanus orientalis*, L., and *P. acerifolia;* nat. order, *Platanaceæ*), chiefly valued for their shade; the walnut (*Juglans regia*, L.; nat. order, *Juglandaceæ*), also from the south of Europe, a valuable cabinet-work, used for gun stocks; the holm and Turkey

oaks (*Quercus Ilex*, L., and *Q. Cerris*); the Spanish chestnut (*Castanea vulgaris*, Lam.; nat. order, *Cupulifera*), considerably grown for hop-poles; the Cedar of Lebanon (*Cedrus Libani*, Loud.) and the Deodar (*C. deodara*, Loud.); the silver fir (*Abies pectinata*, DC.), the spruce (*Picea excelsa*, Link.), and the Douglas fir (*Pseudotsuga Douglasii*, Carrière). The last named, though growing more rapidly and forming softer wood in Scotland than in its native Oregon, bids fair to become the most important timber tree of North Britain.

Home-grown timber is but a fraction of that used in the United Kingdom, large quantities being imported from Canada, the Baltic, and the United States, especially deals; besides teak from India, greenheart from Guiana, mahogany from Honduras, etc.

In 1885 the value of timber imported was £14,000,000, of which £4,500,000 came from Canada and the East and West Indies.

Norway and Sweden.

The chief forests of Norway are in the east, and consist of Scots fir, spruce, and birch. Of 80,000,000 cubic feet annually exported, more than half is sent to the United Kingdom. The Norway spruce (*Picea excelsa*, Link.) is common to all the mountain ranges of Europe, to the Arctic Circle, reaching 150 or even 180 feet in height, and more than 15 inches in diameter. Its wood, known as "white deal," or "whitewood," is used for ladders, scaffolds, sounding-boards, sabots, and gunpowder charcoal. In the forest nurseries of Stavanger, the chief trees cultivated are Scots fir, spruce, and willow (*Salix lanceolata*, Sm.), the latter species, introduced from the Netherlands, being used for hoops. The average export of timber from Norway between 1861 and 1882 was between 800,000 and 900,000 tons.

Scots fir and spruce form also the staple of the forests in Sweden, the greater portion of which are in the northern and central provinces. The river Dal forms the northern limit of the oak and beech in a wild state; but they are cultivated in much higher latitudes. The white birch (*Betula alba*, L.) is found in profusion throughout the kingdom, being chiefly used for firewood, but locally for furniture, agricultural implements, etc. The aspen (*Populus tremula*, L.), which is also common, is used in the manufacture of matches and of paper pulp. The former manufacture yielded £225,000 in 1872, of which £168,000 worth were exported. Paper pulp is made also from pine-wood. It was first exported in

1872, when nearly all (to the value of £55,000) came to Great Britain. Alder, elm, and lime are also common, and attain a large size in the more favoured districts. The pine-wood is used in house and ship-building; and both as pit props and in a manufactured form, as window and door frames, etc., constitutes a chief article of export, an increasing quantity annually reaching Great Britain.

Denmark.

There are extensive forests of beech, the chief indigenous trees besides being spruce, Scots fir, birch, aspen, and oak. The wood of the Scots fir is known as redwood, or red deal, as distinguished from the whitewood of the spruce, but some varieties yield "yellow deal." The chief oak forests are on the islands of Falster and Lolland. Plantations of the Swiss *Pinus montana*, Duroi; the American *Picea alba;* the Norway spruce (*P. excelsa*, Lam.); and the silver fir (*Abies pectinata*, DC.), have been extensively carried out in West Jutland.

Holland.

There are no indigenous forests in Holland; but beech, poplar, willow, ash, and elm are much planted. *Ulmus major*, L., the Dutch or sand elm, was introduced into England from Holland, and the exportation of alder-buckthorn has been already noted. The sand dunes are extensively planted with conifers.

Belgium.

There are extensive forests in Brabant, Flanders, and the Ardennes, the latter largely consisting of beech.

Germany.

North Germany possesses extensive forests on the Harz and Thuringian mountains, in East Prussia, the Odenwald in Hesse, the Westerwald and Taunus range in Nassau, and the Vosges. The chief trees are *Pinus sylvestris*, L., the "kiefer," "weissföhre," "gemeine föhre," and *Picea excelsa*, "fichte," "rothtanne." The silver fir (*Abies pectinata*, DC.; "edeltanne," "weistanne") is abundant in the Vosges and in the Black Forest of Baden and Würtemburg, where we also have birch, "birke;" beech, "rothbuche;" and oak, "eiche;" whilst in Bavaria the larch, "gemeine lärche," is extensively grown. In the Spessartwald, near Aschaffenburg, there are large masses of oak and extensive coniferous plantations, more than

a quarter of the area of Bavaria being under wood, much of it being mountainous, and there being a large demand for fuel. No less than twenty-three per cent. of the area of the kingdom of Prussia is forest land. The chief trees in the province of Prussia are the "kiefer" (*Pinus sylvestris*, L.) and "fichte" (*Picea excelsa*), which comprise three-fourths of the whole. "Lärche" (*Larix europæa*, DC.) is rare, "buchen" (*Fagus sylvatica*, L.), "hainbuchen" or "weissbuchen" (*Carpinus Betulus*, L.), "eiche" (*Quercus*), "spitzahorn" (*Acer platanoides*, L.), "bergahorn" (*A. Pseudo-platanus*, L.), "ruster" (*Ulmus campestris*, Spach.), "erle" (*Alnus glutinosa*, Gaertn.), "birke" (*Betula alba*, L.), "sahlweide" (*Salix Caprea*, L.), "werftweide" (*S. acuminata*, Sm.), "linde" (*Tilia europæa*, L.), "eberesche" (*Pyrus Aucuparia*, L.), and "aspe" (*Populus tremula*, L.) also occur.

Similar trees occur in Posen and Pomerania, "Hasel" (*Corylus Avellana*) being also grown in the latter province. "Edeltanne" (*Abies pectinata*, DC.) is recorded for Silesia, and the "weymuthskiefer" (*Pinus Strobus*, L.) and "esche" (*Fraxinus excelsior*, L.) also for Brandenburg. The "faulbaum" (*Rhamnus Frangula*) and "eibe" (*Taxus baccata*, L.) are among the chief trees of the province of Saxony, and the "pappel" (*Populus*), "weissfichte" (*Abies pectinata*), and "zwergkiefer" (*Pinus Pumilio*) among those of Schleswig-Holstein; otherwise the lists from the various provinces are similar to the above. Oak is largely used for artillery purposes, and aspen and birch in ship-building. By the budget for 1880, 50,000 marks were assigned for the introduction of foreign trees, including *Pinus Laricio*, "swartzkiefer," from S. Europe; *Abies Nordmanniana*, from the Caucasus; *Picea sitchensis*, from Japan, together with some other conifers; and the following species from North America:—

Pinus rigida, ponderosa, and *Jeffreyi.*
Abies (Pseudotsuga) Douglasii.
Thuja gigantea.
Cupressus Lawsoniana.
Juniperus virginiana.
Carya alba, amara, aquatica, porcina, and *tomentosa.*
Juglans nigra.
Quercus rubra.
Betula lenta.
Populus monilifera.
Acer Negundo, saccharinum, and *dasycarpum.*

The Duchy of Gotha contains 44,140 hectares of forest, 85 per cent. of which is pine, the chief other trees being beech, spruce, larch, oak, maple, ash, birch, and elm. Coburg contains 15,718 hectares of similar forests.

The Kingdom of Saxony includes about 465,000 hectares of timber land, the chief species being *Quercus sessiliflora*, Sm., "traubeneiche, steineiche," *Fagus sylvatica*, *Fraxinus excelsior*, *Betula alba*, *Alnus glutinosa*, *Picea excelsa*, *Pinus sylvestris*, *Abies pectinata*, and *Larix europæa*.

Hesse-Darmstadt includes about 168,000 acres, and Baden nearly 1,270,000 acres of forest; *Pinus sylvestris* and *Strobus*, *Picea excelsa* and *Abies pectinata*, and *Larix europæa*, being the prevailing conifers. Hessian fir-trees are in great demand in Holland for ship-building.

The Kingdom of Wurtemburg includes 596,000 hectares, or over 30 per cent. of its area, of forest, comprising the pine-wood districts of the Black Forest, Upper Swabia, and the Jaxt Circle; and the hardwood forests of the Swabian Alps and of the "Unterland." The spruce, silver fir, and Scots fir are the chief conifers, and are mostly used as timber, much being floated down the Rhine. Spruce bark is mixed with that of the oak in tanning, and the chopped branches are used as litter. Oak, of which both *Quercus pedunculata*, Ehrh., "stieleiche, sommereiche," and *Q. sessiliflora*, Sm., occur, is largely in demand for ship-building in Holland, and for general purposes at home. Beech is the chief fuel, but is also used for ships' keels, by carriage-builders, and by chair-makers. Ash, hornbeam, elm, linden, birch, alder, and maples (*Acer campestre*, L., "feldahorn;" *A. platanoides*, L.; and *A. Pseudo-platanus*, L.), are also used in carriage-building, turnery, etc., and as fuel; whilst aspen is in demand for paper and match manufacture.

Austrian Empire.

The forests of the Austrian Empire occupy 66,600 English square miles, those of Austria being more than 30 per cent. of its whole area, and those of Hungary 26·6 per cent. They are situated mainly in the mountain regions of the Carpathians, Transylvania, Galicia, Bohemia, the Alps, Croatia, and Slavonia. Spruce, silver fir, larch; *Pinus montana*, Duroi; *P. sylvestris*, and *P. nigricans*, Host. (= *P. austriaca*, Höss.), are the prevailing species; but beech, several species of oak, including *Q. Robur*, L.; *Q. lanuginosa*, Th.; and *Q. Cerris*, L., with elm (*Ulmus campestris* and *U. effusa*); poplar; chestnut, "edelkastanie;" and walnut, "wallnussbaum," occur at lower altitudes, especially in the south. Dalmatia and Croatia come within the Mediterranean area, and have also *Quercus Pseudo-suber*, Sant.; *Q. Ilex*, L.; and *Q. coccifera*, L., together with the olive, mulberry, and fig (*Ficus Carica*, L.). These are mostly

cultivated, as is also the Corsican pine,[1] *Pinus Laricio*, Poir., which is nearly allied to the black Austrian pine (*P. nigricans*). The timber is used mainly for fuel and building purposes; but in addition to 67,000,000 cubic feet of timber, the forests are estimated to yield 4,000,000 cwts. of bark (larch and oak) for tanning, 500,000 cwts. of gall-nuts, 250,000 cwts. of turpentine and resin, and 100,000 cwts. of potash annually. The turpentine of the larch is known, from its port of shipment, as "Venice turpentine;" that from the silver fir as "Strasburg turpentine."

Russia.

With by far the largest forest area of any European country (469½ million acres), both absolutely and relatively to its entire extent, Russia is very unequally wooded. Two-thirds of her forests are in the north-east; in the north-west they form from 30 to 50 per cent. of the whole area; in the central and western districts 27 per cent.; in the south-west 2·5 per cent.; and in Little Russia only ·7 per cent. The spruce is the prevalent tree in the north, the Siberian larch (*Larix sibirica*, Led.) in the north-east, whilst *Pinus sylvestris*, L., has a very wide range in latitude, flourishing in the Caucasus (41½ deg. N. lat.) and Crimea, as well as on the shores of the Baltic. A variety, *P. Frieseana*, Wich., extends further north in Lapland, Finland, and Sweden. Birch is abundant, and in the central and southern districts oak, beech, ash, lime, walnut, and box. Besides an enormous home consumption for fuel and building, Russia exports coniferous wood largely from Archangel and the Baltic ports, about 7000 tons of tar per annum, paper pulp from the aspen, large quantities of "Russia matting," the "bast," or inner bark of the linden (Russian "Lipa"), *Tilia europæa*, L., and boxwood from the Caucasus. The latter is brought to England in billets from 3 to 8 ft. long, and from 3 to 18 in. in diameter, fetching from £4 to £15 per ton. The Corsican pine (*P. Laricio*) is extensively planted in the Crimea; and while beech and Scots fir occur on the northern slopes of the Caucasus, on the south side we have *Abies orientalis*, Led., *Abies Nordmanniana*, *Pterocarya caucasia* (nat. order, *Corylaceæ*), introduced into England about 1830, and *Zelkova crenata*, Spach, a heavy, hard, reddish wood at heart, with a lighter and elastic sapwood, similar to its ally the elm (nat. order, *Ulmaceæ*). It takes a good polish, and is used for furniture.

[1] From it pine wool and pine oil are prepared.

Other important species are the "cedar" (*Pinus Cembra*, L.), forming large forests in Perm and Volgoda, the aspen, the hornbeam (*Carpinus Betulus*), distinguished as "white beech" from *Fagus sylvatica*, the "red beech," and forming whole forests near Kieff and Poltava, the alder (*Alnus incana*), and the European larch (*Larix europæa*) in Poland. Of the total timber output for 1880 from Government forests, of over 2,900,000 cubic fathoms, spruce constituted 37·5 per cent., pine 27·8, soft woods (birch, lime, aspen, etc.) 19·5, and hard woods (oak, beech, etc.) 8·8 per cent. Walnut and boxwood form articles of export. Plantations have been made along several railways to protect them from snowdrifts, and *Pinus Pinaster* has been used, with smaller plants, on the sand-plains at Aleschki, on the Dnieper.

Roumania.

Stated by Dr Cleghorn to contain two million acres of forest land, Roumania produces oak, walnut, beech, yew, silver fir, and spruce. *Quercus Cerris*, L., the Turkey oak, is very characteristic of the Balkan peninsula, as is also the horse-chestnut and the Macedonian *Pinus Peuce*.

France.

Though having forests in almost every Department, covering in all about one-seventh of her area, France imports large quantities of common woods, as well as the more valuable exotic kinds.

The principal timber trees of France are oaks, "chênes," of which *Quercus Robur*, L.; *Q. apennina*, Lam.; *Q. lanuginosa*, Th.; *Q. Toza*, Bosc.; *Q. Cerris*, L.; *Q. Pseudo-suber*, Sant.; *Q. Ilex*, L.; *Q. Suber*, L.; *Q. occidentalis*, Gay; *Q. coccifera*, L.; and *Q. pseudo-coccifera*, Dsf., are indigenous. *Q. Suber* and *Q. occidentalis* are considerably cultivated in the south and in Corsica. The latter does not ripen its acorns until the second year. Cork is stripped from *Q. Suber* after twelve or fifteen years' growth, and then at intervals of from seven to ten years; but the two first gatherings are useless for "corks." Beech ("hêtre"), ash ("frêne"), elm ("orme"), sycamore ("fauxplatane"), and other maples ("erables"), birch ("bouleau"), walnut ("noyer"), and the Lombardy poplar (*Populus fastigiata*), are important deciduous trees; the silver fir and spruce ("sapin rouge") are abundant in the Vosges and Jura mountains; and *Pinus halepensis*, Mill., the Aleppo pine, and *P. Pinaster*, Soland. ap.

Aiton, the maritime or cluster pine (*P. maritima*, Poiret apud Lam.), are indigenous, and much cultivated in the south. The spruce yields "Burgundy pitch" and "frankincense;" whilst "Bordeaux turpentine" is obtained by cutting long slips off the stem of the cluster pine, with which the dunes of the south-west coast have since 1789 been so successfully planted. Among other woods, taken mostly from those exhibited by the French Government at the Exhibition of 1867, are the following:—

Alnus glutinosa, Gärtn. (nat. order, *Betulaceæ*), "Aune." In hydraulic works.

Amygdalus communis, L. (nat. order, *Rosaceæ*), "Amandier." Same purposes.

Arbutus Unedo, L. (nat. order, *Ericaceæ*), "Arbousier." Charcoal.

Berberis vulgaris, L. (nat. order, *Berberidaceæ*), "Epine vinette." Cabinet work and dyeing.

Carpinus Betulus, L. (nat. order, *Cupuliferæ*), "Charme." Carts, cogs, etc.

Castanea vulgaris, Lam. (nat. order, *Cupuliferæ*), "Châtaignier." Making of gallic acid.

Celtis australis, L. (nat. order, *Ulmaceæ*), "Micocoulier." Whip handles.

Ceratonia siliqua, L. (nat. order, *Leguminosæ*). Cabinet work and firewood.

Citrus medica (nat. order, *Aurantiaceæ*). Cabinet work.

Cornus mas, L. (nat. order, *Cornaceæ*). Machinery, tools, etc.

Corylus Avellana, L. (nat. order, *Cupuliferæ*), "Noisetier." Hoops, poles, etc.

Cratægus azarolus (nat. order, *Rosaceæ*). Firewood.

Cytisus Laburnum, L. (nat. order, *Leguminosæ*), "Faux ébénier." Inlaying, turning, etc.

Erica arborea, L. (nat. order, *Ericaceæ*), "Bruyère." "Briar" pipes.

Euonymus europæus, L. (nat. order, *Celastraceæ*).

Ilex Aquifolium, L. (nat. order, *Ilicineæ*), "Houx." Cabinet work.

Juniperus Oxycedrus, L. (nat. order, *Coniferæ*), "Goudron huile decade."

J. Sabina, L., "Sabine." Cabinet work, pencils, etc.

Olea europæa, L. (nat. order, *Oleaceæ*), "Olivier." Cabinet work.

Pinus Cembra, L., "Pin cembro." Cabinet work.

P. uncinata. Various purposes.

P. Laricio, Poir., "Pin noir." Building, etc.

Prunus Avium, L. (nat. order, *Rosaceæ*), "Cerisier merisier," or "Cerisier sauvage." Cabinet work and firewood.

P. Mahaleb. Same purposes.

P. armeniaca, L., "Abricotier." Same purposes.

Pyrus communis, L. (nat. order, *Rosaceæ*), "Poirier." Various uses.

P. Malus, L., var. *acerba*, "Pommier." Musical instruments.

Rhamnus alaternus (nat. order, *Rhamnaceæ*). Cabinet work and charcoal.

Rhus pentaphylla (nat. order, *Anacardiaceæ*). Dyeing and tanning.

Salix alba, L. (nat. order, *Salicineæ*), "Saule." Various purposes.

S. Caprea, L., "Saule Marceau." Hop poles.

Sorbus torminalis, Crantz (nat. order, *Rosaceæ*), "Alisier torminal." Cabinet work.

S. Aria, Crantz, "Alisier blanc." Good for turning and firewood.

S. domestica. Engraving, tools and musical instruments.
Styrax officinale (nat. order, *Styracaceæ*). Firewood.
Tilia grandifolia (nat. order, *Tiliaceæ*), "Tilleul." Carving, etc.
Ulex europæus, L. (nat. order, *Leguminosæ*), "Ajone." Firewood.[1]

Switzerland.

With one-sixth of its whole area under forest, Switzerland presents a characteristically mountain flora. Its chief timber trees are *Picea excelsa*, DC. (= *Pinus abies*, L.), used for planks, building, firewood, and charcoal; *Abies pectinata*, which reaches altitudes of 4000 ft., similarly employed; *Pinus sylvestris*, L., preferred to the two former as fuel; *P. Cembra*, L., "Arve" or "Zirbelkiefer," a white, worm-resisting wood, esteemed for milk tubs and for flooring; *Larix europæa*, DC., extending to an altitude of 3000 ft., used for sleepers; *Quercus Robur*, L., *Q. pedunculata*, Ehrh., and *Juglans regia*, L., extending to 1800 ft., but not abundant; *Fagus sylvatica*, L., up to 3000 ft., the best wood for fuel and charcoal; maples, ash, birch, hornbeam, alder, and aspen.

Italy.

With only about 12 per cent. of its area under forest, Italy, owing to the Apennine range, presents a great diversity in its flora. *Pinus Pinea*, L., the "Stone pine," the seeds of which are eaten, and which once formed the beautiful forest of Ravenna; and the olive (*Olea europæa*, L.), the fruit and oil of which form one of the chief products of the country, are the two most characteristic trees. The wood of the latter, used for ornamental purposes, is very beautiful. The slopes of the Alps and Apennines are clothed with chestnut and silver fir, *Pinus halepensis*, the manna or flowering ash (*Fraxinus Ornus*, L.; nat. order, *Oleaceæ*), mulberry, beech, larch, and a variety of oaks, are also common. The mulberry (*Morus alba*, L.) is grown chiefly as food for the silkworm. Among the oaks are enumerated *Quercus Robur*, L.; *Q. Ilex*, L., the "holm" oak; *Q. montella*, *Q. pyrenaica*, *Q. Æsculus*, L.; *Q. Cerris*, L.; *Q. Pseudo-suber*, Sant.; *Q. Suber*, L.; *Q. pseudo-coccifera*, Dsf.; and *Q. coccifera*, L., besides other forms not generally admitted as species. [See Laslett, pp. 43-76.] The service and white beam are used as in France, and, in addition to the laburnum, the hard wood of the Judas tree (*Cercis Siliquastrum*, L.; nat. order, *Leguminosæ*) is also indigenous. Besides the sycamore (*Acer*

[1] See also Mathieu, "Flore Forestière," 1877.

obtusatum, Kit.), which ranges into Hungary, and reaches 40 to 60 ft., also occurs; but *A. platanoides*, L. ("Acero riccio"), from which sugar can be prepared, is found only in the mountains.

Spain and Portugal.

The Iberian peninsula is deficient in forest; but on the north coast there is much *Pinus Pinaster*, and on the Pyrenees, *P. Laricio*, *P. pyrenaica*, and *P. halepensis* occur, which, south of Lisbon, are replaced by *P. Pinea*, and on the limestone mountains of Grenada by *Abies Pinsapo*, Boiss. The chestnut, the holm oak, and the cork oak, are the chief broad-leaved trees of the peninsula, the former being cultivated, as in Italy and Sicily, for its fruit.

In leaving the consideration of European trees, reference must be made to the extensive planting of Australian species of *Eucalyptus* (nat. order, *Myrtaceæ*), especially *E. Globulus*, in the south of Europe; to *Quercus Ballota*, the acorns of which are eaten in Sardinia; to *Abelicea cretica*, Sm. (nat. order, *Ulmaceæ*), the aromatic wood of which is known as "false sandal-wood;" and to a variety of cedar discovered by Sir Samuel Baker in the interior of Cyprus.

ASIA.

The most comprehensive survey of the flora of Asia is perhaps that by General Strachey in the *Encyclopædia Britannica*,[1] from which the following is mainly condensed. We may perhaps consider the Continent as forming nine chief botanical provinces—viz., (1.) the northern, or Siberian; (2.) that of the Southern Steppes, passing north-eastwards into 1; south-eastwards into (3.) the Thibetan region; eastwards into (4.) the Chinese and Japanese having much affinity with the flora of North America; (5.) that of Asia Minor, Syria, and Persia, an eastward extension of the Mediterranean region; (6.) the desert region of Arabia; (7.) Afghanistan; passing into (8.) Northern India; and (9.) the Indian Tropical Monsoon region.

1. Siberia.

The absence of oak, as of heaths, east of the Urals is characteristic, though *Larix sibirica*, Led., shows the close connection of this flora with that of Northern Europe. Pines extend to 70 deg. N.; and

[1] Ninth edition, vol. ii., pp. 692-694, *s.v.* "Asia."

Picea cephalonica and birch are characteristic of the mountains; and willows, alders, and poplars, of the plains.

2. The Southern Steppes, Turkestan, and Mongolia, and
3. Thibet,— are practically treeless.

4. Northern China.

The flora of the interior of China is but little known. *Pinus koraiensis* occurs in Corea, and *P. Bungeana* in Northern China. *Larix Kæmpferi* and *Cupressus funebris* are further representatives of the Gymnosperms. Oaks, among which are *Quercus mongolica* and *Q. dentata*, point to the connection of this flora with that of the Himalayas; and other interesting trees, introduced into England about a century ago, are *Magnolia Yulan* (or *M. conspicua*, Salisb.), *Kölreuteria paniculata*, and *Ailantus glandulosa*. The "lily tree," as the name Yu-lan signifies, reaches 40 or 50 feet in height, and is allied to other deciduous species in Japan and in the Himalayas. *Kölreuteria paniculata*, Laxm. (nat. order, *Sapindaceæ*), grows only to 20 or 40 feet in height. *Ailantus glandulosa*, Desf. (nat. order, *Simarubeæ*), reaching 50 or 60 feet, is known in German as "Götterbaum;" in Italian, as "Albero di paradiso." It has been extensively planted near Odessa, and is commonly grown for ornament in England, and for shade in the eastern United States. It is the food of the Asiatic silkworm, *Bombyx cynthia*. The recent discovery of a tulip tree (*Liriodendron*; nat. order, *Magnoliaceæ*) in the interior, connects the flora of North China with the tertiary fossil floras of Europe, as well as with the existing flora of America.

The following timbers from Hongkong, some of which are not, however, indigenous, were exhibited at the Colonial and Indian Exhibition. They are named, according to Mr Bentham's "Flora Hongkongensis" (London, 1861):—

Acacia arabica, Willd. (Leguminosæ.)
A. pennata, Willd.
Actinodaphne chinensis, Nees. (Lauraceæ.)
Adenanthera pavonina, L. (Leguminosæ.)
Aleurites triloba, Forst. (Euphorbiaceæ.)
Aporosa frutescens, Blume. (Euphorbiaceæ.)
Aquilaria grandiflora, Benth. (Thymelaceæ.)
Artocarpus hypargyrea, Hance. (Artocarpaceæ.)
A. integrifolia, L.
Bischoffia javanica, Bl. (Euphorbiaceæ.)
Camellia hongkongensis, Seem. (Camelliaceæ.)
C. reticulata, Lindl.

Casuarina equisetifolia, Forst. (Casuarineæ.)
Celtis sinensis, Pers. (Ulmaceæ.)
Chrysophyllum pentagonum. (Sapotaceæ.)
Cinnamomum Burmani. (Lauraceæ.)
C. necsianum, var. *petiolare*.
Cratoxylon polyanthum, Korth. (Hypericaceæ.)
Cunninghamia sinensis, Br. (Coniferæ.)
Cyminosma pedunculata, DC. (Rutaceæ.)
Dalbergia Sissoo, Roxb. (Leguminosæ.)
Elæocarpus lanceæfolius, Roxb. (Tiliaceæ.)
Endospermum chinense, Benth. (Euphorbiaceæ.)
Engelhardtia chrysolepis. (Juglandaceæ.)
Ficus Harlandi, Benth. (Artocarpaceæ.)
F. hispida, Linn. fil.
F. Wightiana, Wall.
Gordonia anomala, Sareng. (Camelliaceæ.)
Grewia microcos, L. (Tiliaceæ.)
Guettardella chinensis, Champ. (Rubiaceæ.)
Ilex cinerea, Champ. (Ilicineæ.)
Liquidambar chinensis, Champ. (Hamamelideæ.)
Machilus velutina, Champ. (Lauraceæ.)
Mangifera indica, L. (Anacardiaceæ.)
Melaleuca Leucadendron, L. (Myrtaceæ.)
Melia Azedarach, L. (Meliaceæ.)
Myrica rubra, Sieb. & Zucc. (Myricaceæ.)
Nephelium Litschi, Camb. (Sapindaceæ.)
N. longanum, Camb.
Olea marginata, Champ. (Oleaceæ.)
Ormosia emarginata, Benth. (Leguminosæ.)
O. pachycarpa, Champ.
Paratropia cantoniensis, Hook. & Arn. (Araliaceæ.)
Pentaphylax euryoides, Gardn. (Camelliaceæ.)
Pinus sinensis, Lamb. (Coniferæ.)
Pithecolobium lucidum, Benth. (Leguminosæ.)
Quercus salicina, Blume. (Cupuliferæ.)
Q. Championi, Benth.
Q. fissa, Champ.
Q. Harlandi, Hance.
Q. thalassica, Hance.
Rhaphiolepis indica, Lindl. (Rosaceæ.)
Sarcocephalus cordatus, Miq. (Rubiaceæ.)
Schima Noronhæ, Reinw. (Camelliaceæ.)
Spondias mangifera, Pers. (Anacardiaceæ.)
Stillingia sebifera, Michx. (Euphorbiaceæ.)
Styrax suberifolia, Hook. & Arn. (Styracaceæ.)
Syzygium nervosum, DC. (Myrtaceæ.)
S. odoratum, Hook. & Arn.
Ternstræmia japonica, Thunb. (Camelliaceæ.)
Tetranthera citrifolia, Juss. (Lauraceæ.)
T. monopetala, Roxb.
Viburnum odoratissimum, Lindl. (Caprifoliaceæ.)
Vitex Lourieri, Hook. & Arn. (Verbenaceæ.)

Notes upon many of these species will be given in discussing the Indian timbers, many of them being, as, indeed, Mr Bentham points out, are three-fifths of the flora of Hongkong, indigenous to India.

Japan.

Japan, except in some of the hilly districts, has a luxuriant vegetation. The chief forests consist of *Cryptomeria japonica*, the "Japanese cedar," or "sugi," introduced into England in 1843. It ranges chiefly from 500 to 1200 ft. above the sea, and attains a height of 60 to 100 ft., with a diameter of 4 or 5 ft. It, together with *Planera japonica*, "keyaki" (nat. order, *Ulmaceæ*), is used for common lacquer ware. Among pines there are *Pinus parviflora*, Sieb. and Zucc.; *P. densiflora*, Sieb. and Zucc.; and *P. Thunbergii*; *Sciadopitys verticillata*, the umbrella pine; *Picea polita*; *Pseudolarix Kæmpferi*, the golden larch; *Thuja* or *Thujopsis dolabrata*, Sieb. and Zucc., "hiba;" *Biota orientalis*, the arbor vitæ; *Tsuga Sieboldii* (= *Abies Tsuga*), "Tsuganoki;" *Retinospora* or *Chamæcyparis obtusa*, the sun tree, "hinoki," reaching 70 ft. to 100 ft. high, which is burnt for charcoal; and *Gingko biloba*, L. (= *Salisburia adiantifolia*), the maiden-hair tree, "Ishio," being the chief other representatives of the *Coniferæ*. The evergreen oaks, such as *Quercus glabra* and *Q. serrata*, Thunb., and the maples, including *Acer polymorphum* and *Negundo cissifolium*, are among the finest Japanese trees; the mulberry, walnut, chestnut, and plum (*Prunus pseudo-cerasus*), "sakara," are cultivated, as is also the persimmon (*Diospyros Kaki*; nat. order, *Ebenaceæ*); and among other characteristic trees are the lacquer tree (*Rhus vernicifera*), and vegetable wax-tree (*R. succedanea*; nat. order, *Anacardiaceæ*); the camphor (*Cinnamomum camphora*, Nees, = *Laurus*); *Broussonetia papyrifera*, the paper mulberry; *Magnolia hypoleuca*, "honoki," used for charcoal; the "ailanto" (*Ailantus glandulosa*, Desf.; nat. order, *Simarubeæ*); the "yen ju" (*Sophora japonica*, L.), the flower-buds of which afford a dye; and *Paulownia imperialis*, "kizi," from the wood of which the best lacquered articles are made.[1]

5. Asia Minor, Syria, and Persia.

The flora of this area differs but little from that of Southern Europe. *Quercus pseudo-coccifera* is by far the most abundant tree in Syria: *Q. Ægilops*, whose acorn-cups are imported for dyeing under the name of valonia, *Q. Cerris*, and *Q. infectoria*, whence Turkey gall-nuts are obtained, are also Levantine species; and

[1] Franchet and Savatier, "Enumeratio plantarum in Japonia . . .," Paris, 1875-79.

forests of oak ("mazu") occur also in Persia, as does also the beech ("nûs") and elm ("azad"), the walnut (*Juglans regia*, L.), which probably has here its original home, as has also the myrtle (*Myrtus communis*), which yields an oil and a hard wood useful in turnery; plane, sycamore, ash, yew, box, and juniper. Maples, hornbeams, and hazels also occur in this region; and the terebinth (*Pistacia Terebinthus;* nat. order, *Anacardiaceæ*), and the cultivated *Melia Azedarach*, L., the "bead tree," "Indian lilac," or "pride of India," are also characteristic features in the vegetation. The coniferæ are represented by the Caucasian *Picea orientalis* and *Abies Nordmanniana*, Link., the Levantine *A. cilicica* and *A. cephalonica*, Loud., by the Aleppo pine (*Pinus halepensis*), and above all by the cedar of Lebanon (*Cedrus Libani*, Loud.), which probably gives place to the Himalayan variety, *C. deodara*, Loud., in the eastern mountains. The cultivation of the olive is one of the chief industries of Syria, and the manufacture of articles from its beautiful wood, an important trade in Jerusalem. The "iron-wood" of Persia is a species of *Parrotia* (nat. order, *Hamamelideæ*).

6. The Desert Region of Arabia.

The flora of this region is practically continuous with that of Northern and Eastern Africa, extending from the Cape Verde Islands into Abyssinia and round the Persian Gulf, through Biluchistan, and part of Afghanistan to the Indus. Almost all the plants are glaucous, many spinose, leaves being little developed, whilst gums and resins and pungent aromas are the rule. Trees are rare: *Pistacia*, *Terebinthus*, *Celtis*, *Dodonæa*, *Populus*, and *Phœnix dactylifera*, L., the date palm, being the chief. *Balsamodendron Myrrha*, Ehrenb. (nat. order, *Burseraceæ*), yields myrrh; and *Acacia nilotica* is said to have been the ancient "shittim-wood;" but this name has been also referred to *Dalbergia Sissoo*, the "shisham" of India.

7. Afghanistan.

At a height from 6000 to 10,000 feet we have *Cedrus deodara*, Loud.; *Picea excelsa*, Link.; *Pinus longifolia*, Roxb.; *P. Pinaster*, Soland.; *P. Pinea*, L.; larch, yew, hazel, and walnut, which latter, with various evergreen and kermes oaks, descend to lower heights, where they are mixed with alder, ash (apparently the "sir-kasht," or manna-yielding *Fraxinus Ornus*, L.), "khinjak," *Pistacia Khinjuk*, J. E. Stocks, which yields a gum mastic, and on the north

P. vera, L., the Pistacio; whilst down to 3000 feet we have the olive and *Zizyphus*. This flora passes into that of the Western Himalayas.

8. Northern India.

The trees which do not require the moist heat of equatorial regions, and can resist the drought from April to June, are *Leguminosæ*, such as *Butea*, *Bauhinia*, *Acacia*, and *Dalbergia*; *Bombax*, *Shorea*, *Nauclea*, and *Lagerstræmia*. *Magnoliaceæ*, *Camelliaceæ*, oaks, and Rhododendrons are distinctive of the Himalaya, *Cedrus deodara* being hardly indigenous east of the sources of the Ganges, whilst *Pinus longifolia* forms much of the forest on the warm slopes. The tea-shrub (*Thea assamica*), the *Aucuba*, *Abelia*, and *Skimmia* are typical of the westward extension of the Chino-Japanese type; and the absence of *Tilia* and *Fagus* is also characteristic. *Abies Brunoniana* and *Smithiana* and the larch (unknown in the western part of the Himalayas) are found at 8000 feet in Sikim, the yew and *Abies Webbiana* at 10,000 feet, whilst *Pinus longifolia* descends to the tropical zone. In Kumaon we have a more tropical flora, including *Moringa*, *Bombax*, *Butea*, *Anogeissus*, *Erythrina*, *Acacia*, *Bauhinia*, *Nauclea*, and *Ulmus integrifolia*, and still *Pinus longifolia*. In Kashmir the plane and Lombardy poplar flourish, and the vegetation, which in the higher mountains hardly differs even in species from that of Afghanistan, Persia, and Siberia, has an eminently European aspect, as has also the flora of Western Thibet, in which, however, the juniper and poplar are the only trees besides cultivated fruit-trees. The pines of the Himalayas do not yield durable timber; but the deodar is much used, the "sâl" (*Shorea robusta*, Gaertn.; nat. order, *Dipterocarpeæ*), the "toon" (*Cedrela Toona*, Roxb.; nat. order, *Meliaceæ*), and "sissoo," "shisham," or "rose-wood" (*Dalbergia Sissoo*, Roxb.; nat. order, *Leguminosæ*), belonging to the lower levels, *i.e.*, below 3000 feet, though the "toon" reaches the altitude of 7000 feet in Sikim. *Acacia arabica*, Willd., the "babúl," represents the Arabian type of North-West India.

9. The Indian Monsoon Region.[1]

This region includes (1.) the Dekkan, or Western Peninsula;

[1] The multiplicity of languages in India renders such a series of the various vernacular synonyms for each tree, as is given in Mr Gamble's "Manual," impossible in an essay such as the present.

(3.) the Malay Peninsula, with the intervening (2.) Andaman Islands; (4.) Sumatra; (5.) Java; (6.) Borneo; (7.) the Moluccas; (8.) New Guinea; (9.) the Philippines, and, as we have already seen, to some extent South China; and (10.) Ceylon. *Dipterocarpaceæ*, or wood-oil trees, *Apocynaceæ*, *Ficus*, and other rubber-yielding trees, and pitcher-plants (*Nepenthes*) are characteristic. Teak (*Tectona grandis*, L.; nat. order, *Verbenaceæ*) flourishes in the heavy rainfall of Southern India, the Malay Peninsula, Java, and Sumatra, its northern limit being about 25° N.; whilst the other chief trees of this area belong to the orders *Terebinthaceæ*, *Sapindaceæ*, *Meliaceæ*, *Clusiaceæ*, *Camelliaceæ*, *Leguminosæ*, *Sapotaceæ*, and *Lauraceæ*. The Indian timbers in the following alphabetical list are mainly those of the celebrated "Index collection."

Abies Smithiana, Forbes. Himalayan spruce.

A. Webbiana, Lindl. Himalayan silver fir.

Acacia arabica, Willd. "Babúl," "gum arabic" (*Leguminosæ*), reaching 50 to 60 feet in height and 3 to 4 feet in diameter, and forming a hard, durable wood for wheels, presses, tool-handles, etc. Its bark is used in dyeing and tanning, and its gum is "gum arabic."

A. Catechu, Willd. "Khair." "Catechu," or "cutch," or "terra japonica," of which 3000 tons were imported in 1877, is obtained from the heart-wood.

A. ferruginea, DC. "Khair."

A. leucophlœa, Willd.

Acer cæsium, Willd. (*Acerineæ.*) "Trekhan."

A. Campbelli, Hook. fil. & Thom.

A. lævigatum, Willd.

A. pictum, Thunb.

Acrocarpus fraxinifolius, Wight. (*Leguminosæ.*) "Mandania."

Adina cordifolia, Hook. fil. & Thom. (=*Nauclea cordifolia*, Roxb.). "Haldu." (*Rubiaceæ.*) A hard wood used in Burmah for making combs.

Adenanthera pavonina, L. "Redwood," "red sandal-wood," "Rakta-chandan." (*Leguminosæ.*) The hard red heart-wood is used in building and cabinet-work and as a red dye, and the red seeds for ornaments.

Ægle Marmelos, Correa. "Bael" fruit. (*Aurantiaceæ.*)

Æsculus indica, Colebrooke. (*Sapindaceæ.*) "Bankhor."

Afzelia bijuga, A. Gray. "Shoondul" or "Pynkado," a small evergreen with red-brown, hard, heart-wood; used in building and for clubs. (*Leguminosæ.*)

Ailantus excelsa, DC. (*Simarubeæ.*) "Maha rukh."

Alangium Lamarckii, Thwaites. (*Cornaceæ.*) "Akola."

Albizzia amara, Boivin. (*Leguminosæ.*) "Lallei."

A. Julibrissin, Durazz. "Pink siris." Heart-wood, almost black, used for furniture.

A. odoratissima, Benth. "Lasrin." The very hard, dark brown heart-wood takes a good polish, and is used for wheels, oil-mills, and furniture.

A. procera, Benth. "Safed Siris." Brown, banded heart-wood, which is durable, and suited to the same purposes as the last.

A. stipulata, Boivin. "Sirin."

Alnus nepalensis, D. Don. (*Betulaceæ.*) "Kohi."

Alstonia scholaris, R. Br. "Chatwan" (*Apocynaceæ.*) The soft, white, perishable wood is used for blackboards, whence its name; also for tea-chests, coffins, etc.; and it yields a rubber.

Altingia excelsa, Noronha. "Nan-ta-roop." (*Hamamelideæ.*) A useful tree, reaching 150 to 180 feet high, and 5 to 6 feet in diameter.

Amoora cucullata, Roxb. (*Meliaceæ.*) "Amur."

A. Rohituka, W. & A. "Rohituka."

A. spectabilis, Miq.

Anacardium occidentale, L. The Cashew-nut. "Kaju." (*Anacardiaceæ.*)

Anogeissus acuminata, Wall. (*Combretaceæ.*) "Chakma."

A. latifolia, Wall. "Dhaura." Reaches 200 feet in height and more than 3 in diameter; has a tough, purplish heart-wood, used for boat-building, axe handles, furniture, etc.; and has leaves which are used in tanning.

A. pendula, Edgeworth.

Anthocephalus Cadamba, Benth. & Hook. fil. "Kaddam." (*Rubiaceæ.*)

Aquilaria Agallocha, Roxb. "Eagle-wood," or "aloes-wood," and a resin ("Lign aloes") which is burnt as incense. (*Thymelaceæ.*)

Artocarpus Chaplasha, Roxb. "Chaplash." A durable, yellow-brown wood, used for canoes, tea-chests, furniture, etc. (*Artocarpaceæ.*)

A. hirsuta, Lamk. "Aini."

A. integrifolia, L. "Kanthal." "Jack" fruit tree. The yellow-brown heart-wood takes a polish; is used for furniture, cabinet work, the backs of brushes, etc.; and yields a yellow dye.

Balsamodendron Mukul, Hook. "Gugal." (*Burseraceæ.*)

Barringtonia angulata, Gaertn. Gum. (*Myrtaceæ.*)

Bassia butyracea, Roxb. "Phalwara." Butter tree. (*Sapotaceæ.*)

B. latifolia, Roxb. "Mahwa wood." A hard, red-brown wood used for sleepers, furniture, etc., but rarely felled, as the flowers are used as food.

B. longifolia, Willd. "Mee" or "Illupi" wood. Hard, flexible wood, used for a variety of purposes.

Bauhinia purpurea, L. "Koliar." (*Leguminosæ.*)

B. retusa, Ham. "Kural." Red-white wood and "Semla Gum."

Beilschmiedia Roxburghiana, Nees. (*Lauraceæ.*)

Berrya Ammonilla, Roxb. "Halmillila." (*Tiliaceæ.*)

Betula Bhojpatra, Wallich. "Bhujpattra." (*Betulaceæ.*)

B. cylindrostachys, Wall.

Bischoffia javanica, Bl. "Kein." (*Euphorbiaceæ.*)

Bombax malabaricum, DC. "Shembal." Silk cotton. (*Malvaceæ.*)

Borassus flabelliformis, L. "Tal." Palmyra palm. (*Palmaceæ.*)

Boswellia serrata, Roxb. (*Burseraceæ.*)

B. thurifera, Colebrooke. "Salei." "Olibanum," used in incense.

Briedelia retusa, Spreng. (*Euphorbiaceæ.*)

Buchanania latifolia, Roxb. "Chirauli." (*Anacardiaceæ.*)

Bucklandia populnea, R. Br. (*Hamamelideæ.*)

Butea frondosa, Roxb. "Dhak." (*Leguminosæ.*) Yields a "lac."

Buxus sempervirens, L. "Papri." (*Buxineæ.*)

Cæsalpinia Sappan, L. "Bakam." "Sappan-wood," a dye. (*Leguminosæ.*)

Callicarpa arborea, Roxb. (*Verbenaceæ.*)

Calophyllum Inophyllum, L. "Alexandrian laurel," "poon," "tatamaka." (*Guttiferæ.*) A red-brown wood used for sleepers, spars, etc.; yielding a resin; whilst from the seeds is pressed an oil used as a liniment in rheumatism.

C. polyanthum, Wallich.

Canarium bengalense, Roxb. (*Burseraceæ.*)

C. strictum, Roxb. "Black dammar." A gum resin.

Carallia integerrima, DC. (*Rhizophoraceæ.*)

Carapa moluccensis, Lam. (*Meliaceæ.*)

Careya arborea, Roxb. (*Myrtaceæ.*)

Casearia glomerata, Roxb. (*Camydaceæ.*)

Cassia Fistula, L. "Indian Laburnum." (*Leguminosæ.*)

C. siamea, Lamk. "Beati." Nearly black heart-wood, used in Burmah for mallets, etc.

Castanea vesca, Gaertn. (*Cupuliferæ.*)

Castanopsis indica, A. DC. (*Cupuliferæ.*)

C. rufescens, Hook. fil. & Thom.

Casuarina equisetifolia, Forst. "Iron-wood." (*Casuarineæ.*) Used also as a dye, and its ash in soap-making. "Chow," etc., in Borneo, *q. v.*

Cedrela serrata, Royle. (*Meliaceæ.*)

C. Toona, Roxb. "Toon." "Thitkado" in Burmah. Grows 80 to 100 feet high, and 20 feet round. Its brick-red, soft, durable wood, "Moulmein cedar," or "Indian mahogany" in the English market, resists ants, and is used for furniture, carving, etc.

Cedrus deodara, Loud. (*Coniferæ.*) The most durable Himalayan conifer; used for sleepers, furniture, etc.; and yields an oil, by distillation from the wood, used medicinally, and to anoint skin floats for crossing rivers. Introduced into England 1831.

Celtis australis, L. (*Ulmaceæ.*)

Chickrassia tabularis, A. Juss. "Chittagong wood," "Chickrassi." (*Meliaceæ.*) Hard wood with satiny lustre, used for furniture and carving. The bark is very astringent.

Chloroxylon Swietenia, DC. "Satin wood," "Behra." (*Meliaceæ.*) A hard, beautiful wood, taking a polish, and used for furniture, cabinet work, turnery, etc. It yields a wood oil.

Cinnamomum glanduliferum, Meissn. "Nepal Camphor wood." (*Lauraceæ.*)

C. Tamala, Nees. "Cinnamon," "Cassia lignea."

Cocos nucifera, L. "Cocoa-nut palm," "Porcupine wood;" used in inlaying, for rafters, etc. Nuts and fibre. (*Palmaceæ.*)

Connarus speciosus. (*Connaraceæ.*)

Cordia fragrantissima, Kurz. (*Boragineæ.*)

C. Macleodii, Hook. fil. & Thom.

C. Myxa, L.

Corylus Colurna, L. (*Corylaceæ.*)

Croton argyratus, Bl. "Choonoo." Hard, yellow wood. (*Euphorbiaceæ.*)

Cupressus torulosa, Don. "Himalayan Cypress." (*Coniferæ.*)

Dalbergia lanceolaria, L. (*Leguminosæ.*)

D. latifolia, Roxb. "Indian Blackwood," "Rosewood," "Sitsal." Used for furniture, carving, railway sleepers, and other purposes.

D. latifolia, var. *sissoides*. Nilghiri blackwood.

D. Sissoo, Roxb. "Sisso," "Shisham," "Chittim" of Scripture (?), "Rosewood." Hard, strong, and elastic; unequalled for wheels for gun-carriages, etc., but scarce.

Dammara orientalis. "Dammar pine." (*Coniferæ.*)

Daphnidium pulcherrimum, Nees. (*Lauraceæ.*)

Dichopsis polyantha, Benth. & Hook. fil. (*Sapotaceæ.*)

Dillenia indica, L. (*Dilleniaceæ.*)

D. pentagyna, Roxb.

D. speciosa, Thunb.

Diospyros burmanica, Kurz. (*Ebenaceæ.*)

D. Ebenaster. "Bastard Ebony" of Ceylon.

D. Embryopteris, Pers.

D. Melanoxylon, Roxb.

Dipterocarpus alatus, Roxb. (= *D. turbinatus*, Gaertn. f. ?). "Gurjun" or "Kanyin" wood. Wood used in building, but not durable. Yields "gurjun balsam" or wood oil. (*Dipterocarpeæ.*)

D. Kurzii, Hiern.

D. lævis, Ham. "Kangin."

D. obtusifolius, Teysm.

D. tuberculatus, Roxb. "Eng." Hard, reddish wood, used in Burmah for door-posts. Clear, yellow resin.

Dolicandrone stipulata, Seem. (*Bignoniaceæ.*)

Drimycarpus racemosus, Hook. fil. (*Anacardiaceæ.*)

Duabanga sonneratioides, Buch. "Bandorhulla." (*Lythraceæ.*)

Dysoxylon binectariferum, Hook. fil. (*Meliaceæ.*)

Echinocarpus dasycarpus, Benth. (*Tiliaceæ.*)

Elæocarpus lanceæfolius, Roxb. (*Tiliaceæ.*)

Elæodendron glaucum, Pers. (*Celastraceæ.*)

E. integrifolium. White wood for cabinet work.

Engelhardtia spicata, Bl. (*Juglandaceæ.*)

Eriolæna Candollei, Wall. (*Sterculiaceæ.*)

Erythrina suberosa, Roxb. (*Leguminosæ.*)

Erythroxylon monogynum, Roxb. "Bastard sandal-wood." (*Erythroxylaceæ.*) Hard, dark brown wood; takes a polish; is used instead of sandal-wood; and yields an oil used as varnish.

Eugenia alternifolia, Wight. (*Myrtaceæ.*)

E. Arnottiana, Wight.

E. Jambolana, Lam. "Jam," "Jamoon," "Jambool."

E. operculata, Roxb., var. *obovata*, Kurz.

Euonymus Hamiltonianus, Wall. (*Celastraceæ.*)

Fagræa fragrans, Roxb. "Anan." (*Strychnaceæ.*)

Ficus bengalensis, L. "Banyan." (*Artocarpaceæ.*)

F. glomerata, Roxb. "Kathgúlar."

Flacourtia Ramontchi, L'Heritier. (*Bixineæ.*)

Fraxinus floribunda, Wall. (*Oleaceæ.*)

Garcinia speciosa, Wall. (*Guttiferæ.*)

Gardenia latifolia, Aiton. (*Rubiaceæ.*)

Garuga pinnata, Roxb. "Kharpat." (*Burseraceæ.*) Reddish heart-wood; not durable. Used for fuel or building. Bark used in tanning, and leaves as fodder.

Givotia rottleriformis, Griff. (*Euphorbiaceæ.*)

Gluta tavoyana, Wall. (*Anacardiaceæ.*)

G. travancoria, Beddome.

Gmelina arborea, Roxb. "Gumhar." (*Verbenaceæ.*) A small, but valuable, substitute for teak.

Grewia asiatica, L. "Phalsa." (*Tiliaceæ.*) Hard, yellowish wood. Bark used in rope-making.

G. tiliæfolia, Vahl.

Gyrocarpus Jacquini, Roxb. (*Combretaceæ.*)

Hardwickia binata, Roxb. "Anjan." (*Leguminosæ.*) 50 to 120 ft. high. Very hard, dark red or purplish heart-wood; very heavy and durable. Used for sleepers, etc. The tree yields a gum, and the bark a strong and valuable fibre.

H. pinnata, Roxb. "Kolaou." Brown heart-wood, used in building; exudes a balsam.

Heritiera littoralis, Dryander. "Sunder" or "Sundri." From the Sundarbunds; used for boats, beams, etc. (*Sterculiaceæ.*)

Heterophragma Roxburghii, DC. (*Bignoniaceæ.*)

Holarrhena antidysenterica, Wall. "Kurchi" or "Conessi" bark. (*Apocynaceæ.*)

Homalium tomentosum, Benth. (*Samydaceæ.*)

Hopea odorata, Roxb. "Thingan." (*Dipterocarpeæ.*) Hard, durable, yellowish wood, heavier than teak. The chief timber of Southern Tenasserim, yielding a yellow resin or "dammar."

H. parviflora, Beddome.

Hymenodictyon excelsum, Wall. (*Rubiaceæ.*)

Ilex dipyrena, Wall. (*Ilicineæ.*)

I. Wightiana, Wall.

Juglans regia, L. Walnut. "Akhrot." (*Juglandaceæ.*)

Juniperus excelsa, M. Bieb. "Himalayan pencil cedar." (*Cupressineæ.*)

J. recurva, Ham. "Weeping blue juniper."

Lagerstræmia Flos-reginæ, Retz. "Jarul," "Ajhar," "Blood-wood." (*Lythraceæ.*) The most valuable timber of Sylhet. Very durable in water.

L. microcarpa, Wight.

L. parvifolia, Roxb., var. *majuscula*, C. B. Clarke. "Bandára" (="Bakli" of the N. W. Provinces ?).

L. tomentosa, Presl.

Larix Griffithii, Hook. fil. & Thom. Eastern Himalayas. (*Coniferæ.*)

Lebediropsis orbicularis, Müll. Arg. "Garrar." (*Euphorbiaceæ.*)

Limonia acidissima, L. (*Aurantiaceæ.*)

Lophopetalum littorale, Kurz. (*Celastraceæ.*)

L. Wallichii, Kurz.

Machilus odoratissima, Nees. (*Lauraceæ.*)

Magnolia Campbellii, Hook. fil. & Thom. Eastern Himalaya. (*Magnoliaceæ.*)

Mangifera indica, L. "Mango." (*Anacardiaceæ.*)

M. sylvatica, Roxb.

Melanorrhœa usitata, Wall. "Varnish Tree of Burmah." (*Anacardiaceæ.*)

Melia Azadirachta, L. (=*M. indica*, Brandis). "Neem," "Margosa." (*Meliaceæ.*) Sacred idols and furniture made from wood; bark a febrifuge; and bitter, acrid yellow oil from fruit.

M. Azedarach, L. "Persian Lilac," "Bead Tree," "Pride of India," "Bastard Cedar." "Maha Neem." Wood for furniture; bark, anthelmintic; oil from fruit; and seeds as beads.

Memecylon edule, Roxb. (*Melastomaceæ.*)

Mesua ferrea, L. "Nagesar," "Iron-wood." (*Guttiferæ.*) Heart-wood dark red, extremely hard, used for gun-stocks, building, etc. In Ceylon an oil expressed from seed.

M. speciosa, Choisy.

Michelia Champaca, L. "Champa," "Sampagi-maram." (*Magnoliaceæ.*) Reaches 4½ feet diameter. Olive-brown wood, soft, takes polish, durable.

M. excelsa, Blume. "Bara Champ," "White Magnolia." The chief wood of Darjeeling.

Miliusa velutina, Hook. fil. & Thom. (*Anonaceæ.*)

Millettia pendula, Benth. (*Leguminosæ.*)

Millingtonia hortensis, L. (*Bignoniaceæ.*)

Mimusops Elengi, L. "Bakul," "Molsari." (*Sapotaceæ.*)

M. indica, A. DC.

M. littoralis, Kurz. "Andaman bullet-wood." Red, hard, durable wood.

Morinda exserta, Roxb. (*Rubiaceæ.*)

Moringa pterygosperma, Gaertn. "Horse-radish tree," from the flavour of its bark and roots; "Ben" oil from its seeds. (*Moringaceæ.*)

Morus cuspidata, Wall. (*Urticaceæ.*)

M. serrata, Roxb.

Myristica Irya, Gaertn. "Maloh." (*Myristicaceæ.*)

Nephelium Longana, Camb. (*Sapindaceæ.*)

Nyctanthes Arbor-tristis, L. "Harsinghar." (*Oleaceæ.*)

Odina Wodier, Roxb. "Kiamil." (*Anacardiaceæ.*) Red-brown heart-wood variously employed, but not very durable. Bark used in tanning, and gum medicinally and as size.

Olea ferruginea, Royle. (*Oleaceæ.*)

Ougeinia dalbergioides, Benth. "Sandan." (*Leguminosæ.*) Mottled red and brown, tough, durable wood, which takes a polish, and is variously used; and a red astringent gum.

Pentace burmannica, Kurz. "Thitko;" "Kathitka" in Burmah. (*Tiliaceæ.*) Yellow-red, soft, light wood.

Pentacme siamensis, Kurz.

Pentaptera glabra, Roxb. (*Combretaceæ.*) A substitute for teak, reaching 60 to 80 feet in height and 6 to 8 feet in diameter, in Pegu.

Photinia Lindleyana, Wight. (*Rosaceæ.*)

Phyllanthus Emblica, L. (*Euphorbiaceæ.*)

Pinus excelsa, Wall. "Bhotan pine." (*Coniferæ.*) Reaches 200 feet in height, with cones 1 to 2 feet long.

P. Gerardiana, Wall. Afghanistan and West Himalayas.

P. Kasya, Royle.

P. longifolia, Roxb. "Chir." Not durable, but easily worked. Used for charcoal, tar, turpentine, and fuel, and the bark for tanning.

P. Merkusii, Jungh. "Tinyu-ben." Torches, masts.

Pistacia integerrima, Stewart. (*Anacardiaceæ.*)

Pithecolobium dulce, Benth. (*Leguminosæ.*)

Planchonia littoralis, Van Houtte. "Bambway Nee." (*Myrtaceæ.*) Valuable, red-brown, hard wood. Andamans.

Platanus orientalis, L. (*Platanaceæ.*)

Podocarpus bracteata, Bl. (*Coniferæ.*)

P. latifolia, Wall.

Pongamia glabra, Vent. (*Leguminosæ.*)

Populus ciliata, Wall. (*Salicineæ.*)

P. euphratica, Oliv.

Premna longifolia, Roxb. (*Verbenaceæ.*)

Prosopis spicigera, L. "Jhand." Very hard, tough, but not durable, purplish brown wood, used for fuel in the Pânjâb, and for building.

Prunus Puddum, Roxb. (*Rosaceæ.*)

Pterocarpus indicus, Willd. "Padouk," "Andaman Redwood." (*Leguminosæ.*) A beautiful dark-red wood of large dimensions, valuable for furniture. The tree also yields an astringent gum known as "kino."

P. Marsupium, Roxb. "Bija Sâl," "Bastard Teak." A harder, brown wood, much used for building and furniture; it also yields kino.

P. santalinus, L. fil. "Red Sanders Wood." Hard, red banded wood, chiefly used in tanning and dyeing, but sometimes in building.

Pterospermum acerifolium, Willd. (*Sterculiaceæ.*)

P. suberifolium, Lam.

Quercus annulata, Sm.; *Q. dilatata*, Lindl.; *Q. Griffithii*, Hook. fil. & Thom.; *Q. Ilex*, L.; *Q. incana*, Roxb.; *Q. lamellosa*, Sm.; *Q. lappacea*, Roxb.; *Q. pachyphylla*, Kurz; *Q. semecarpifolia*, Sm.; *Q. spicata*, Sm. (*Cupuliferæ.*)

Rhizophora Mangle, L. "Mangrove." (*Rhizophoraceæ.*)

R. mucronata, Lamk.

Rhododendron arboreum, Sm. (*Ericaceæ.*)

Rhus Cotinus, L. (*Anacardiaceæ.*)

Saccopetalum tomentosum, Hook. fil. & Thom. (*Anonaceæ.*)

Salix tetrasperma, Roxb. (*Salicineæ.*)

Salvadora oleoides, L. (*Salvadoraceæ.*)

S. persica, L. "Tooth-brush Tree."

Sandoricum indicum, Cav. "Thitto." (*Meliaceæ.*) Red-wood, which takes a polish; used for carts, boats, etc.

Santalum album, L. "Sandalwood," "Chandal." (*Santalaceæ.*) Yellowish brown, very hard, scented wood, used for carving, and largely exported to China, Arabia, and England. The fragrant oil is distilled from it.

Sapindus emarginatus, Vahl. "Soap-nut." (*Sapindaceæ.*) An oil from the seeds.

S. rubiginosa, Baill.

Scepa (*Lepidostachys*) *Roxburghii*. "Kokra-wood." Hard. (*Euphorbiaceæ.*)

Schima Wallichii, Chois. "Chilauni." (*Camelliaceæ.*)

Schleichera trijuga, Willd. "Kosum." (*Sapindaceæ.*) Strong, durable wood, used for mills, etc. The fruit is edible; the seeds yield an oil, and the tree a "lac."

Schrebera swietenioides, Roxb. (*Oleaceæ.*)

Semecarpus Anacardium, L. fil. "Marking-nut." (*Anacardiaceæ.*)

Shorea obtusa, Wall. "Thitya." (*Dipterocarpeæ.*) A hard, durable, dark wood, variously employed.

S. robusta, Gaertn. "Sál." The most used timber of Northern India; brown, streaked, hard, and durable. The tree yields a white aromatic resin, "Dhoona," or "Dammar" pitch, used in incense; and an oil from the seeds.

S. Talura, Roxb. "Talura." Hard, grey, building timber.

S. Tumbuggaia, Roxb.

Sideroxylon tomentosum, Roxb. (*Sapotaceæ.*)

Sonneratia acida, L. fil. (*Lythraceæ.*)

S. apetala, Buch.

Soymida febrifuga, A. Juss. "Indian red-wood," "Rohan." (*Meliaceæ*) (=*Swietenia febrifuga.*) Heart-wood reddish black, hard and durable. Used for ploughshares, etc., and the bark as a febrifuge.

Spondias mangifera, Pers. "Hog Plum." (*Anacardiaceæ.*) Wood valueless; yields a gum; fruit edible.

Stephegyne parvifolia, Korth. "Kaddam." (*Rubiaceæ.*) Pinkish-brown wood, used for turning, etc.

Sterculia fœtida, L. "Jangli badam." (*Sterculiaceæ.*) Wood valueless.

S. urens, Roxb. "Gulu."

S. villosa, Roxb. "Udal."

Stereospermum chelonioides, DC. "Pader." Hard, grey, useful wood. Roots, leaves, and flowers medicinal. (*Bignoniaceæ.*)

S. suaveolens, DC.

Strychnos Nux-vomica, Roxb. "Snake-wood," "Kuchla." (*Strychnaceæ.*) Brownish grey, hard wood. The alkaloid "Strychnia" is obtained from the seed.

S. colubrina, L. "Snake-wood" of Malabar and Java, a remedy for snake-bites.

S. potatorum, L. fil. "The Clearing-nut," used to clear drinking water. "Nirmali."

Talauma Hodgsoni, Hook. fil. & Thom. (*Magnoliaceæ.*)

Tamarindus indica, L. "Tamarind," "Amli." (*Leguminosæ.*) Purplish heart-wood irregularly disposed, very hard, suitable for turning. Fruit edible, and leaves used in curry.

Tamarix articulata, Vahl. (*Tamariscineæ.*)

Taxus baccata, L. Himalayas, large. (*Taxineæ.*)

Tecoma undulata, G. Don. (*Bignoniaceæ.*)

Tectona grandis, L. "Teak," "Sagun." (*Verbenaceæ.*) The most valuable timber of India, very heavy and durable. Used for ship-building; resists termites. An oil, used instead of linseed, is extracted in Burmah.

Terminalia Arjuna, Beddome. "Arjun." (*Combretaceæ.*)

T. belerica, Roxb. "Babela," "Myrobalan wood." Wood used for planks. Fruit, "myrobalans."

T. bialata, Wall.

T. Chebula, Roxb. "Harra." Hard, grey wood, takes a polish, and is used for furniture and building. The fruit, "Chebulic," or "Black myrobalans," used in dyeing.

T. myriocarpa, Henck. & Mull. Arg.

T. tomentosa, W. & A. "Saj" or "Sein." Hard, dark brown, finely variegated, much used, but not durable wood. Bark used as black dye, and in tanning.

Ternstræmia japonica, Thunb. (*Camelliaceæ.*)

Tetranthera laurifolia, Jacq. (*Laurineæ.*)

T. monopetala, Roxb.

Thespesia populnea, Corr. "Tulip" or "Portia" tree. (*Malvaceæ.*)

Turpinia nepalensis, Wall. (*Sapindaceæ.*)

Ulmus integrifolia, Roxb. "Papri." (*Ulmaceæ.*) Yellowish-grey, useful wood. An oil from seeds.

U. Wallichiana, Planchon.

Vaccinium Leschenaultii, Wight. (*Ericaceæ.*)

Vatica laccifera, W. & A. (*Dipterocarpaceæ.*)

V. lanceæfolia, Bl.

Vateria indica, L. Wood not valuable, but exudes a gum animi, known as "piney varnish," "white Dammar," or "Indian copal," which is good and hard. (*Dipterocarpaceæ.*)

V. malabarica does so also.

V. Tumbugaia, W. & A.

Vitex altissima, L. (*Verbenaceæ.*)

V. leucoxylon, L. fil., and *V. pubescens*, Vahl.

Wendlandia exserta, DC. (*Rubiaceæ.*)

Wrightia tinctoria, R. Br. "Dudhi." (*Apocynaceæ.*) White, hard, small wood, used in turnery.

W. tomentosa, Roem. & Schult.

Xanthophyllum flavescens, Roxb. (*Xanthophyllaceæ.*)

Xylia dolabriformis, Benth. "Pynkado," "Pyengadu," or "Ingazylocarva" of Burmah; "Jambea" or "Yerool" of Bombay; "Boja" of Godavery (? = "Acle" (*Mimosa Acle*) of Philippines); "Ironwood" of Pegu and Arracan. (*Leguminosæ.*) Beautifully mottled, dark brown, hard, durable heart-wood, used for boat-building, sleepers, telegraph posts, etc. The Burmese is better than that grown in Southern India.

Zizyphus Jujuba, Lamk. "Kul." (*Rhamnaceæ.*)

Z. xylopyra, Willd.

West Indian mahogany, *Eucalyptus*, and *Cinchona* are now extensively planted in India.

In 1875-76 India exported over 60,000 tons of teak, 14,000 tons of myrobalans, 9000 tons of catechu, 4000 tons of shell-lac, 700 tons of caoutchouc, and 500 tons of sandalwood.

[See further "The Forests and Gardens of South India," by H.

Cleghorn, M.D., etc., 1861; "Flora Sylvatica for Southern India," by Major R. H. Beddome, 1873; "Forest Flora of North-west and Central India," by Dr D. Brandis, 1874; "Forest Flora of British Burma," by Sulpiz Kurz, 1877; and "Manual of Indian Timbers," by J. S. Gamble, 1881, in which 906 species, belonging to 432 genera, are included.]

(2.) Andaman Islands.

With a generally Burmese facies to the flora, skirted with mangrove swamps, but largely composed of deciduous trees, the following are, according to Kurz ("Report on the Vegetation of the Andaman Islands," Calcutta, 1870), among the more important species of the Andamans, the native names being Burmese, except where otherwise stated:—

Adenanthera pavonina, L. "Bwaegyee." Cabinet work. (*Leguminosæ.*)

Albizzia elata, Benth. "Beymadah," Andamanese; "Kakho," Burmese. (*Leguminosæ.*)

Artocarpus Chaplasha, Roxb. "Kai-darek," Andamanese; "Toungpeing." 100 feet. (*Artocarpaceæ.*)

**Barringtonia speciosa*, L. "Peebdah" or "Dubdah," Andamanese; "Kyaigyee." 50 feet, 25 inches diameter. Equal to mahogany. (*Lythraceæ.*)

**Bruguiera gymnorhiza*, Lam. "Bew-boc." 60 to 70 feet, 25 to 30 inches diameter. (*Rhizophoraceæ.*)

**Calophyllum Inophyllum*, L. "Phung-nyet," the "Poon" of India. 60 feet, 5 feet diameter. Masts, etc. (*Guttiferæ.*)

C. Wallichii. "Pantagah." 60 feet, 2 feet diameter. As valuable as the last.

Carapa obovata, Bl. "Ooldah," Andamanese. 40 to 50 feet, 25 to 30 inches diameter. (*Meliaceæ.*)

C. moluccensis, Juss. "Penlayung." Smaller, strong.

**Careya sphærica*, Roxb. "Beereegah," Andamanese. (*Myrtaceæ.*) 60 to 70 feet, 50 inches diameter.

Dillenia aurea, Sm. "Zimbjoon." 90 to 100 feet, and 36 inches diameter. (*Dilleniaceæ.*)

Erioglossum edule, Bl. (= *Sapindus rubiginosus*). "Hseik-khyæ." 50 feet, 12 to 15 inches diameter. (*Sapindaceæ.*)

Garcinia speciosa, Wall. "Palawah," "Proah." 50 feet, and 25 inches diameter. Heavy. (*Guttiferæ.*)

**Heritiera littoralis*, Dryander. "Soondree," English; "Pinlay-kanazoc." 25 to 30 feet, 12 to 15 inches diameter. Durable. (*Sterculiaceæ.*) Boats, piles.

Hopea odorata, Wall. "Thengan." 60 to 70 feet, 30 inches diameter. (*Dipterocarpeæ.*) Boats, oars, etc.

H. suavis, Wall. "Engyin." Similar.

**Intsia palembanica*, Miq. (= *Xylia dolabriformis*, Benth.). "Pynkadoo." 40 feet, 20 to 25 inches diameter. (*Leguminosæ.*)

Lagerstræmia hypoleuca, Kurz. "Babdah," "Pyenmah." 80 to 90 feet, 50 inches diameter. (*Lythraceæ.*)

**Mesua ferrea*, L. "Kangan" or "Ganggo." 60 to 70 feet, 29 inches diameter. Very heavy; used for furniture and house-building. (*Guttiferæ.*)

**Mimusops indica*, DC. "Kuppalee theet," "bullet-wood." 80 feet, 60 inches diameter. Very valuable for gun stocks, etc. (*Sapotaceæ.*)

Odina Wodier, Roxb. "Huan-bal." 50 to 60 feet, 25 to 30 inches diameter; beautiful, close-grained. (*Anacardiaceæ.*)

Podocarpus polystachya, R. Br. "Theet-kya." 60 to 70 feet. Proposed for engraving. (*Coniferæ.*)

**Pterocarpus dalbergioides*, Roxb. "Padouk," "Djalangadah," Andamanese. 80 to 90 feet, and 6 feet in diameter; yields a Kino. (*Leguminosæ.*)

Pterospermum aceroides, Wall. "Thamajamwai-yoke." 45 to 50 feet, 25 to 30 inches diameter. Reported valuable. (*Sterculiaceæ.*)

Rhizophora mucronata, L. "Bairadah," Andamanese; "Bewmah." 30 to 40 feet, 12 to 15 inches diameter. (*Rhizophoraceæ.*)

Those marked with an asterisk (*) are the most valuable timbers, especially the bullet-wood.

(3.) Malay Peninsula.

The following are among the chief timbers of Johore and Singapore, besides teak in the north of the peninsula. The names are Malay. [Leonard Wray, "Journ. Society of Arts," (1859), vii., 428; Howard Newton, "Notes and Experiments on the chief kinds of Timber in ordinary use in the Straits Settlements, Singapore," 1884.]

Afzelia palembanica. "Miraboo," "Merbân." (*Leguminosæ.*)

Apodytes, sp. "Darroo." (*Olacineæ.*)

Artocarpus, sp. "Kladang." (*Artocarpaceæ.*)

Calophyllum Inophyllum, L. "Biutangore" or "Poon." (*Guttiferæ.*)

Canarium, sp. "Damar Lant." (*Burseraceæ.*)

Dialium indicum. "Krangie" or "Kranju." Indestructible; used for Chinese anchors.

Dipterocarpus, spp. "Rengas" and "Treling." (*Dipterocarpaceæ.*)

Dryobalanops Camphora. "Kapur Baroos." (*Dipterocarpeæ.*)

Eugenia zeylanica. "Kayu Klat." (*Myrtaceæ.*)

Hedycarpus cauliflora. "Lampong."

Hopea, sp. "Seriah." (*Dipterocarpaceæ.*)

H. Meranti. "Meranti."

Rhizophora, sp. "Bucco," "Bâkân." (*Rhizophoraceæ.*)

Sideroxylon malaccense. "Daru." (*Sapotaceæ.*)

Sloetia sideroxylon. "Tampinnis."

Vatica, sp. "Rassak." (*Dipterocarpaceæ.*)

The forests of Siam contain a large amount of teak; other trees being *Garcinia* (various species), yielding gamboge; *G. Mangos-*

tana, L., the mangosteen; *Durio Zibethinus*, DC., the Durian; *Isonandra Gutta*, gutta percha; and *Aquilaria ovata* and *Agallocha*, Roxb., "eagle" or "aloes-wood," yielding "Lign-aloes," a resin burnt as incense.

(4 and 5.) Sumatra and Java.

Not less than a fourth of Java is still covered with forest. In the first, or tropical zone—*i.e.*, up to 2000 feet—*Magnoliaceæ* and *Anonaceæ* prevail, other lofty trees being *Mimusops acuminata*, *Spathodea gigantea*, and *Irina glabra*. In the second zone—*i.e.*, up to 4500 feet—the chief tree is the "Rasamala" (*Liquidambar Altingia;* nat. order, *Balsamiflue*), which yields "liquid storax;" others being "Puspa" (*Schima Noronhæ;* nat. order, *Camelliaceæ*), a fine heavy, red timber; "Ki sapi" (*Gordonia excelsa;* nat. order, *Camelliaceæ*); "Gadok" (*Bischoffia javanica*, Bl.; nat. order, *Euphorbiaceæ*); "Bayur" (*Pterospermum Blumeanum;* nat. order, *Sterculiaceæ*), and *Epicharis densiflora* (nat. order, *Meliaceæ*). Besides the sago palm, other trees are *Pangium edule* (nat. order, *Pangiaceæ*), a hard wood, with edible nuts and a bark used to poison fish; "Kayu Gabas" (*Alstonia scholaris*, R. Br.; nat. order, *Apocynaceæ*); *Dipterocarpus trinervis; Podocarpus cupressina*, which grows to 200 feet high in Java and Penang; *Dryobalanops Camphora*, the Sumatra camphor; *Cratoxylon Hornschuchii* (nat. order, *Hypericineæ*); and *Engelhardtia spicata* (nat. order, *Juglandaceæ*), used for cart-wheels. *Cassia florida*, Vahl., known as "juar," indigenous in Sumatra; the Surian (*Cedrela febrifuga*, Bl.; nat. order, *Meliaceæ*); and *Eucalyptus Globulus* are being largely planted in Java.

(6.) Borneo.

Borneo possesses very extensive forests, besides mangrove swamps, and some most valuable timbers have been sent home by the British North Borneo Company; but unfortunately they are not yet well known, botanically or commercially. Several lists have been printed at Sandakan. They include "Mirabou," *Afzelia palembanica;* "Rassak," *Vatica*, probably three species; "Kayu Kapor," *Dryobalanops Camphora;* "Seriah," "Serayah," "Selangan," "Majow," or "Borneo Cedar," probably a *Hopea* (*Dipterocarpaceæ*), or several species; besides valuable woods, known as "Billian," ant and teredo-proof; "Ballow;" "Compass," allied to "Mirabou;" "Greeting," and "Penago," or "Panagah," known as "Borneo

mahogany." "Billian" is also known as "Borneo iron-wood." *Casuarina equisetifolia*, "Chow" or "Menkabang Penang," used for masts and building; a species of *Calophyllum*, known as "mast;" sandal-wood, and a species of ebony also occur; and sago and sappan-wood are among the products of the island.

(7.) Moluccas.

Here, too, the woods are comparatively little known. India-rubber, gutta-percha, sandal-wood, nutmegs (*Myristica moschata*, growing 20 to 30 feet high, and other species), Dammar (*Dammara orientalis*), and camphor are among the chief products; and "Amboyna wood" (*Pterocarpus?*) is the best known timber.

(8.) New Guinea.

Dense forests cover the greater part of New Guinea, the flora still retaining an Indian facies; *Ficus*, *Casuarina*, *Calophyllum*, *Podocarpus*, *Diospyros*, *Aleurites*, *Canarium*, *Durio*, and *Wormia* being among the chief genera of trees, with many palms, creepers, and ferns. But both *Dammara* and *Araucaria* occur; and, on the shores of the Gulf of Papua, *Eucalyptus* and *Pandanus*, giving an Australian character to the flora; whilst in the sub-alpine mountain flora there are oaks and rhododendrons.

(9.) Philippines.

In a flora essentially Malayan, with a Chinese admixture, the Philippines possess no less than 200 kinds of wood worthy of trial in the arsenal at Manila. Among them are "Padouk" (*Pterocarpus indicus*), "Molave" (*Vitex geniculatus* and *V. altissima*), almost equal to the teak, "Dongon" (*Sterculia cymbiformis*), "Ipel" (*Eperua decandra*), "Lanan" (*Dipterocarpus thurifer*), "Bolongaeta" (*Diospyros pilosanthera*), and others known as "Tindalo," "Vacal," "Malac Malac," "Baucal," "Salomaria," "Anagap," and "Camagon."

(10.) Ceylon.

The greater part of the dry districts of the north-east of Ceylon is still forest, but the trees are mostly small. A collection of 240 species, botanically determined, with Tamil and Sinhalese names, was exhibited in the Colonial and Indian Exhibition, of which the following 56 are reserved under the recent Forest Act:—

Albizzia odoratissima, Benth. "Suriyamara;" "Hurihi," Sinhalese. Used in building.

Artocarpus integrifolia, L. "Kos," Sinhalese; and

A. nobilis. "Del," Sinhalese. Valuable timbers.

Atalantia missionis. "Pamburu," Sinhalese; "Kurundu," Tamil.

Azadirachta indica. "Kohmba," s.;[1] "Vem-pu," T.[2] (=*Melia Azadirachta*, L.).

Bassia fulva. "Wana-mi," s.

B. longifolia, Willd. "Mi," s.; "Illupai," T. Used in building.

**Berrya Ammomilla*, Roxb. "Halmilla," s.; "Katamanakku," T.; "Trincomalee wood." Valuable timber.

Bridelia retusa, Spreng. "Kéta-Kala," s. Used in building.

Calophyllum Inophyllum, L. "Domba," s.; "Thommakottai," T.

C. tomentosum. "Gurn-kina," s.; and

C. Walkeri. "Kina," s. Used in building.

Caralliaintegerrima, DC. "Dawata," s.

Cassia Fistula, L. "Ehela," s.; "Tirukkondel," T.

C. siamea. "Wa," s.

Chætocarpus castanocarpus. "Hedoka," s.

Chickrassia tabularis, A. Juss. "Kulankik," s.; "Kal-otthi," T.

**Chloroxylon Swietenia*, DC. "Burutu," s.; "Mutirai," T.; "Satin-wood." Used for furniture.

Dialium ovoideum. "Gal-siyambala," s.; "Katapulli," T.

Dichopsis grandis. "Kiri-hembilya," s.

Dillenia retusa. "Godapara," s.

**Diospyros Ebenum.* "Kalawara," s.; "Karunkali," T.; "Ebony."

D. Embryopteris, Pers. "Timbiri," s.; "Panichai," T.

D. ovalifolia. "Vedu-kunari," T.

**D. quæsita.* "Kalu-médiriya," s.; "Calamander."

D. Thwaitesii. "Ho-médiriya," s.

Dipterocarpus zeylanicus. "Hora," s.

Eugenia bracteata. "Pandi-kayan," T.

E. Jambolana, Lam. "Maha-dan," s.; "Naval," T.

Homalium zeylanicum. "Liyan," s.

Kurrimia zeylanica. "Uru-honda," "Etheraliya," s.

Lagerstræmia Flos-reginæ, Retz. "Muruta," s. Used in building.

Litsea sebifera. "Bo-mi," s.

Mangifera zeylanica. "Etamba," s.; "Wild Mango."

Melia dubia. "Lunu-midella," s.

Memecylon capitellatum. "Dodankaha," s.

Mimusops Elengi, L. "Munamal," s.; "Makulai," T.

**M. hexandra.* "Palu," s.; "Palai," T.

Mischodon zeylanicus. "Tammana," s.

Myristica Horsfieldia. "Ruk," s.

Nephelium Longana, Camb. "Mora," s.; "Nurai," T. Used in building.

**Persea semecarpifolia.* "Wéwarane," s.

Phyllanthus indicus. "Karawu," s.

Pterospermum suberifolium. "Velanga," s.; "Vinanku," T.

Sarcocephalus cordatus. "Bakmi," s.

Schleichera trijuga, Willd. "Kon," s.; "Kulu," T. "Ceylon Oak."

Strychnos Nux-vomica, Roxb. "Godakaduru," s.; "Kanchurai," T.

Tamarindus indica, L. "Siyambala," s.

Tectona grandis, L. "Tekka," s.; "Teak."

Terminalia glabra. "Kumbuk," s.; "Maruta," T.

Thespesia populnea, Corr. "Suriya," s.

Vatica Roxburghiana. "Mendora," s.

**Vitex altissima*, L. "Milla," s.

V. Leucoxylon, L. fil. "Nebedda," s.; "Minachi," T.

Walsura Piscidia. "Kiri-Kon," s.; "Sadda-veppu," T.

Wormia triquetra. "Diyapara," s.

[1] Sinhalese.

[2] Tamil.

Of these the chief, commercially, are marked with an asterisk; whilst *Artocarpus integrifolia*, *Tamarindus*, and *Tectona* are not indigenous.

["Official Handbook and Catalogue of the Ceylon Court: Colonial and Indian Exhibition," London, 1886. "Enumeratio Plantarum Zeylaniæ," Thwaites, 1864; and "Returns relating to Colonial Timbers," 1878.]

Mauritius, Etc.

Intermediate in the character of the flora, as in position, between India and Madagascar, the Seychelle and smaller Mascarene Islands have been largely denuded of their original forests. In Mauritius the Ebony (*Diospyros reticulata*); the "Tatamaka" (*Calophyllum Inophyllum*, L.); the "Stinking wood" (*Fœtidia mauritiana;* nat. order, *Barringtoniaceæ*), used in foundations, because termite-proof; the "Benzoin" (*Croton Benzoe;* nat. order, *Euphorbiaceæ*); the "Colophane" (*Colophonia*); the Madagascar "Travellers' tree" (*Urania speciosa*); the sub-spontaneous "Mango" (*Mangifera indica*, L.). "Ironwood" and "Bois de Cannelle" are characteristic, and *Eucalypti* are now extensively planted. *Labourdonnasia glauca*, "Bois de natte," is extensively used for ship-building, cabinet-work, and furniture; *Syzygium obovatum*, in building; and *Jambosa venosa* for small planks; whilst *Acacia elata* yields a timber even stronger than teak. There are also many Palms, and a member of that order, the "Coco de Mer," or Double Cocoa-nut (*Lodoicea sechellarum*, L.), is the most characteristic, and one of the most useful plants in the Seychelles group. "Tatamaka;" "Rosewood" (*Thespesia populnea*, Corr.; nat. order, *Malvaceæ*), used for furniture, gun-stocks, etc.; and "Bois rouge" (*Wormia ferruginea*, Baill.; nat. order, *Dilleniaceæ*), are also characteristic. Goats, cattle, and bush-fires have combined to destroy the great bulk of the fine timber forest which covered the island of Rodriguez down to the 17th century; and of the still extant trees, the commonest are *Elaodendron orientale* (nat. order, *Celastraceæ*), and *Latania Verschaffelti*, "Leguat's Plantane" (nat. order, *Palmaceæ*).

Madagascar.

Being almost completely surrounded by a forest-belt from 15 to 20 miles wide, Madagascar possesses a variety of valuable hard-wooded timber trees, which are, however, as yet but little known. The

Travellers'-tree, or "Ravenala" (*Urania speciosa*; nat. order, *Musaceæ*), of which every portion is of some use in building; the "Filao," a species of *Casuarina*; the Madagascar spice (*Ravintsara madagascariensis*); and many other large and brilliantly-blossoming trees, present a facies which is tropically African or endemic, rather than Asiatic.

AFRICA.

Though belonging almost entirely to the equatorial and tropical zones, Africa is divided by its desert regions into well-marked botanical provinces. That of the north, Morocco, Algeria, and Tunis, belongs essentially to the Mediterranean region, *Cedrus atlantica* and *Abies numidica* on Mount Atlas recalling similar associations on the Himalayas, on Lebanon, and in Cyprus. The Sahara is the region of the date-palm; the Soudan, that of the oil and sago palms, the baobab, and the silk-cotton; and this jungle-region is again separated by the desert region of succulent *Euphorbia*, *Aloë*, *Crassula*, and *Mesembryanthemum* from the region of Heaths and *Proteaceæ* in the south.

Morocco.

Though olives, grapes, figs, almonds, dates, chestnuts, walnuts, mulberries, and cork are cultivated, the most interesting species in Morocco are the "'arâr" and the "argan." The "'arâr" (*Callitris quadrivalvis* = *Thuja articulata*, Shaw) is known as the "Atlas Cypress." It grows 30 feet in height, and its sweet-scented wood was the much valued citron-wood of the Romans, probably the "thyine-wood" of the Book of Revelation (xviii. 12), and the "alerce" of the roof of the cathedral (originally a mosque) at Cordova. This tree yields "Gum Sandarach," formerly used as "pounce." The "argan" (*Argania Sideroxylon*; nat. order, *Sapotaceæ*), though seldom exceeding 20 or 30 feet in height, has a girth of 25 feet, and yields a hard wood. Its fruit is eaten by cattle, and crushed for an oil used in cookery. The cork oak is still abundant. [Cosson, "Compendium Floræ Atlanticæ," Paris, 1881.]

Algeria, Etc.

With nearly 5,000,000 acres of forest, about three-fifths under State control, Algeria is rich in timber. *Pinus halepensis* and *P.*

Pinaster, with *Cedrus atlantica* and *Callitris quadrivalvis*, are the chief conifers. *Quercus Suber*, *Q. Ilex*, *Q. castaneæfolia*, and *Q. ballota*, with elm, ash, maple, and olive, are the chief Angiospermous trees. Cork, olives, and olive-oil, and bark for tanning, are the chief products of the forests. Tunis, once well supplied with Aleppo pine (*Pinus halepensis*), is now denuded of timber; and Egypt, rich in date-palms, has no forests, though *Acacia*, *Tamarix*, *Tamarindus*, and *Zizyphus* reach a considerable size and form wood. The sycamore fig (*Ficus sycomorus*), used for making mummy-cases, was originally Egyptian. Abyssinia, the native home of the coffee, has forests on the temperate and humid mountains of the interior, which are, however, less known than the luxuriant vegetation of Central Africa.

Central and Western Africa.

The timber trees of this region are not yet fully ascertained. Stanley mentions *Bassia Parkii*, the "Shea" butter (*Sapotaceæ*); *Oldfieldia africana*, "African teak," a wood introduced into England in 1819, belonging either to the *Sapindaceæ* or *Euphorbiaceæ*; "Kola nut" (*Sterculia acuminata*), known by various names, and much used instead of betel; "Cashew-nut" (*Anacardium*, sp.) and gigantic tamarinds. And from the colonies of the West Coast, together with other undetermined woods, we import *Swietenia Senegalensis* or *Khaya*, "Africa mahogany;" *Pterocarpus erinaceus*, "African Rosewood," which also yields a Kino; *Blighia sapida*, "Akee" (*Sapindaceæ*); and *Carapa guineensis* (*Meliaceæ*), which also yields an oil from its seeds. It occurs also in British Guiana, and is known as "crabwood," and the oil as crab oil. *Baphia nitida*, "barwood" or "camwood" (*Leguminosæ*), is used mainly as a red dye. "Dattock," *Detarium senegalense*, Gmelin (*Leguminosæ*), is a dense dark brown wood.

Natal.

The timber trees of Natal, mostly growing in somewhat inaccessible situations, have unfortunately not yet been completely determined. Among them are—

Calodendron capense, Thunb. "Wild chestnut." 20 to 30 feet, and 2 to 3 feet in diameter. Soft, white. (*Rutaceæ*.)

Celtis rhamnifolius, or *C. Kraussiana*, Bernh. "Camdeboo," "soft grey stinkwood." (*Ulmaceæ*.)

Curtisia faginea. "Umnoiso," "Assegai wood." (*Cornaceæ.*)

**Eckebergia capensis*, Sparrm. "Essen boom," "Cape ash." Tough; used for furniture, etc. (*Meliaceæ.*)

Elæodendron croceum, DC. "Saffron" or "Safforan" wood. (*Celastraceæ.*) 40 to 60 feet, and 3 to 4 feet in diameter. Hard; used for cabinet work, and the bark in tanning.

**Ocotea bullata*, Nees ab E. (= *Oreodaphne.*) "Hard black stinkwood." 50 to 60 feet, and 4 to 5 feet in diameter. Almost equal to teak. (*Lauraceæ.*)

**Olea latifolia.* "Black ironwood," "Tamboti." (*Oleaceæ.*)

Phoberos Ecklonii. "Red pear." (*Flacourtiaceæ.*)

Podocarpus pruinosus, E. M., or *P. Thunbergia.* "Bastard yellow wood." (*Abietineæ.*)

**P. elongatus*, L'Herit. "Yellow wood," or "white yellow wood." 30 to 70 feet, and 3 to 7 feet in diameter.

Pterocelastrus rostratus, Walp. "White pear wood," "Umdogan." 20 to 25 feet. Heavy, durable; much used for wheel felloes. (*Celastraceæ.*)

**Pteroxylon utile*, Eckl. & Z. "Sneezewood," "Neishout," "Umtati." 20 to 30 feet, and 2 to 4 feet in diameter. Handsome furniture wood. (*Sapindaceæ.*)

Royena nitida, Thunb. "Black wood," "Zwaartbast." 10 to 12 feet, and 6 to 12 inches in diameter. Hard, tough, yellow with brown stripes. Fit for furniture. (*Ebenaceæ.*)

**Sideroxylon inerme.* "Soft milkwood." (*Sapotaceæ.*)

**Toddalia lanceolata*, Lam. (= *Vepris.*) "White ironwood," "Umzimbiti." (*Xanthoxylaceæ.*) White, hard wood, used for ploughs, axles, etc.

Water Boom, "Umstvna," and "Knob-thorn," "Unnivengomabile," and many others are undetermined. *Eucalyptus* and *Casuarina* are a good deal planted for fuel, and the colony cannot now export timber; but there are 165,000 acres of forest occupied by heavy timber, besides nearly 2,000,000 acres of mimosa or thorn jungle. The root and bark of *Elephantoriza Burchellii*, "Intolwana," and much black-wattle bark (*Acacia mollissima*), are used in tanning, the latter being a naturalised plant.

Cape Colony.

The chief forests of the colony are in the south and east. Between Cape Town and Port Elizabeth some 150 square miles of forest, known as Knysna, remain under Government control. East of Port Elizabeth are the forests of Alexandria, Bathurst, and East London, near the coast; and some 130 square miles of mountain forest are on the Perie and Amatola mountains north of King William's Town. In the mountains of Clanwilliam are the remains of mighty cedar forests, *Widdringtonia juniperoides* still occurring

on the slopes of the Cederberg, above the winter range of snow. Table Mountain is flanked with woodlands, especially on the south or temperate side, composed of *Leucodendron argenteum*, the "silver tree," which is only indigenous in this district, and three naturalised European species—*Quercus pedunculata*, *Pinus Pinea*, and *P. Pinaster*. The Knysna forest exhibits a semi-tropical luxuriance, the stout yellow woods (*Podocarpus*), the lofty black ironwood (*Olea latifolia*), and the most valuable stinkwood (*Ocotea bullata*), rising out of a densely tangled undergrowth. The increase of stinkwood is the chief end aimed at here. In the Eastern Coast forests stinkwood is unknown, and sneezewood (*Pteroxylon utile*) no longer abundant; but "Septu" (*Halleria elliptica*) and "Cape teak" or "Kajatenhout" (*Atherstonea decussata*) abound in the Alexandria forest; and boxwood (*Buxus?*), with two apparently valuable species known as "bogwood" or "Umcobèza," and "Unzumbit" or "Umtiza," occur in those at East London. In the mountain forests sneezewood, which is now protected by Government, is the most important timber. Among the chief trees are—

Acacia horrida. "Thorn Tree," "Mimosa." Common on the Karoo and north. 20 to 25 feet, and 12 to 18 inches diameter. Bark astringent; wood tough, variously employed. (*Leguminosæ.*)

Atherstonea decussata. "Kajatenhout," "Cape Teak," "Cape Oak." 20 to 30 feet, 12 to 18 inches diameter. Tougher than oak.

Buddleia salviæfolia. "Unkaza," "salic wood." 15 to 20 feet, 10 to 15 inches diameter. Wavy grain; cabinet work, cogs; veneers equal to walnut; suitable for engraving. (*Loganiaceæ.*)

Callitris arborea, Schrad. "Cedar." Cabinet work, etc. (*Coniferæ.*)

C. cupressoides, Schrad. "Sapree wood." 12 feet high.

Calodendron capense, Thunb. "Wild chestnut," "Kastanie." (*Rutaceæ.*)

Capparis albitrunca, Burch. "Witgat Boom." 10 to 42 feet. (*Capparidaceæ.*)

Celastrus acuminatus. "Silk-bark," "Zybast." Turnery, umbrella handles. (*Celastraceæ.*)

C. undatus, L. fil. "Koko tree." 20 to 25 feet. Very heavy.

C. sp. "Black-wood," "Swart-hout."

Celtis rhamnifolia. "Camdeboo stinkwood," "Umounari." (*Ulmaceæ.*)

Cunonia capensis, L. "Rood Els," "Red cedar." 20 to 60 feet, 18 to 24 inches diameter. Tough wood; takes polish; cabinet work. (*Cunoniaceæ.*)

Curtisia faginea. "Assegai," "Umguna." 40 to 80 feet, 3 to 4 feet diameter. Red wood, very tough, heavy and elastic. Spokes, felloes, furniture, etc. (*Cornaceæ.*)

Eckebergia capensis, Sparrm. "Essen wood," "Cape ash," "Umgwenyuizinja." Furniture, sides of waggons, etc. (*Meliaceæ.*)

Elæodendron croceum, DC. "Saffron wood," "Umbomoana." Edible berry. Handsome furniture wood; bark for tanning. (*Celastraceæ.*)

Erythrina Caffra. "Kafir tree," "Umgazi." 50 to 60 feet, 3 to 4 feet diameter. Boxes, canoes, etc.; seeds for necklaces. (*Leguminosæ.*)

Euclea lanceolata. "Bosch guarri." Hard and heavy. (*Ebenaceæ.*)

E. pseudebenus. "Cape ebony." Wood jet black, hard.

E. undulata. "Quar." Heart-wood hard, heavy, deep brown.

E. sp. "Red currant," "Umhlakati." Kafir pipes.

Gardenia Thunbergii, L. "Buffelsbal." Hard, heavy wood, for clubs, tools, axles, etc. (*Rubiaceæ.*)

Gonioma Kamassi, E. Mey. "Kamassi." Cabinet work. "Knysna boxwood." Suitable for engraving.

Grumilia cymosa, E. Mey. "Wild lemon," "Lanumi" (=*Psychotria*). (*Rubiaceæ.*)

Halleria elliptica. "Septee," "Oudehout." (*Scrophulariaceæ.*)

H. lucida, L. "White olive." Hard, tough, fine-grained.

Hartogia capensis, L. "Ladle wood." Resembles mahogany; hard, suitable for cabinet work, turning, etc. (*Celastraceæ.*)

Hippobromus alata. "Horsewood," "Paardepis." White, close-grained wood, used in cabinet work. (*Sapindaceæ.*)

Leucodendron argenteum. "Silver tree." Ornamental leaves. (*Proteaceæ.*)

Milletia Kafra? "Umzumbit" or "Umtiza." The hardest and heaviest wood of South Africa. Kaffir walking-sticks. (*Leguminosæ.*)

Mimusops obovata, Sond. "Red milkwood." Felloes, etc. (*Sapotaceæ.*)

Myrsine melanophleos, R. Br. "Cape beech." (*Myrsinaceæ.*)

Mystroxylon Kubu. "Kaboo Els."

Nicbuhria triphylla, Wend. "Witbosch-hout," "wittehouts," "white wood." Suitable for furniture; light and tough.

Nuxia floribunda. "Vlier." (*Loganiaceæ.*)

Ochna arborea, Burch. "Roodhout," "redwood," "Cape plane," "Umtensema." Strong, durable, suitable for engraving. (*Ochnaceæ.*)

Ocotea bullata, Nees ab E. "Stinkwood" or "laurel-wood." Little inferior to teak; not unlike walnut. Furniture. (*Lauraceæ.*)

Olea foveolata, E. Mey. "Ironwood." Hard, heavy. (*Oleaceæ.*)

O. laurifolia. "Black ironwood," "Iggwanxe." Heart-wood nearly equal to "lignum-vitæ."

O. verrucosa, Link. "Olyvenhout," "Olive-wood," "Olina wood," "Umguma." Takes polish; furniture.

Olinea capensis or *O. cymosa,* Thunb., var. *intermedia.* "Hard pear," "Umnonono." Yellowish, very hard, tough and heavy; suitable for musical instruments. (*Olineæ.*)

Platylophus trifoliatus, Don. "White alder."

Plectronia ventosa. "Schaapdrolletje." Handsome hard wood when polished. (*Rubiaceæ.*)

Podocarpus elongatus. "Outeniqua yellow wood," "Umkoba," "Bastard yellow wood." (*Coniferæ.*)

P. latifolius. "Upright or real yellow wood," "Umceya." Furniture, shingles, etc.

Protea grandiflora, L. "Waggon tree." Felloes, etc. (*Proteaceæ.*)

P. mellifera. "Sugar bush." Ornamental wood, but now used for fuel and its bark in tanning.

Protea, sp. "Terblantz." Hard, heavy wood.

Pteroceclastrus rostratus. "White pear," "Umdakane." Hard, close-grained; suitable for engraving. (*Celastraceæ*.)

P. variabilis. "Kersewood," "Candlewood," "Umbaurila." Burns brilliantly; bark used in tanning.

Pteroxylon utile, Eck. and Z. "Sneezewood," "Nieshout," "Umtati." One of the most durable woods in the world, ranking with jarrah and greenheart. Termite and teredo-proof. For bearings superior to brass, iron, or "lignum-vitæ." (*Sapindaceæ*.)

Rhus lævigata. "Taaibosch." Turnery. (*Anacardiaceæ*.)

R. Thunbergii, Hook. "Klip Els," "Rock ash." Hard, heavy, and tough; suitable for musical instruments.

R. viminalis. "Karroo wood." Tough, elastic wood, used for tent waggon hoops; takes polish.

Royena lucida. "Black bark," "Swartblast," "Umcaza." (*Ebenaceæ*.)

Schotia latifolia, Jacq. "Boerbone." Seeds edible; bark used in dyeing; heart-wood greenish. (*Leguminosæ*.)

Scolopia Ecklonii, Benth. & Hook. fil. (=*Phoberos*). "Red pear." Used by wheelwrights and in mill work. (*Bixaceæ*.)

S. Mundtii, Benth. & Hook. f. "Klipdoorn."

S. Zeyheri. "Thorn" or "wolf pear," "Iqumza elinameva." Useful for cogs; very hard.

Sideroxylon inerme. "White milkwood," "Umgwashu." Whitish durable wood for boats, telegraph poles, etc. (*Sapotaceæ*.)

Strychnos Atherstonei, Harv. "Cape teak." Staves. (*Strychnaceæ*.)

Sycomorus capensis. "Wild fig." Light; takes polish. (*Artocarpaceæ*.)

Trichocladus crinitus. "Ouderbosch," "Sidali." Fuel. (*Hamamelidaceæ*.)

Toddalia lanceolata, Lamk. (=*Vepris*). "White ironwood," "Umzani." Tough and elastic like ash or hickory. (*Xanthoxylaceæ*.)

Virgilia capensis, Lam. "Keurboom." (*Leguminosæ*.)

Widdringtonia juniperoides. "Cedar." As much as 12 feet in diameter. (*Coniferæ*.)

Xanthoxylon capense, Harv. "Knobwood," "Paardepram," "Umnungumabele." 50 to 60 feet. Variously employed. (*Xanthoxylaceæ*.)

["Catalogue of the Exhibits of the Colony of the Cape of Good Hope," Colonial and Indian Exhibition, London, 1886. "Silva Capensis," by L. Pappe, M.D., London and Cape Town, 1862, pp. 60, 8vo.]

Atlantic Islands.

The native ebony of St Helena (*Dombeya melanoxylon*; nat. order, *Byttneriaceæ*), growing 10 to 15 feet high, has been all but exterminated by goats; but *Pinus Pinaster* has been extensively planted. The forest of Agua Garcia, in Teneriffe, consists entirely of evergreen trees of the laurel type, among which the most abun-

dant are *Persea indica*, "Veñatico" or "Madeira mahogany," *Laurus canariensis*, *Ilex platyphylla*, *Myrica Faya*, and *Viburnum rugosum*. *Persea indica*; *Oreodaphne fœtens*, the "Til;" and *Ardisia excelsa*, the "Aderno" (nat. order, *Myrsinaceæ*), occur also in Madeira. *Pinus canariensis* and *Juniperus Oxycedrus* ascend to 6400 feet in Teneriffe. The latter has been almost exterminated in Madeira, where the chief fuel supply is derived from the introduced *Pinus Pinaster*. The mountains in the Azores are chiefly covered with tree-heath (*Erica arborea*, L.), Juniper (*Juniperus brevifolia*, Hochst., closely allied to *J. Oxycedrus*, L.), and Faya (*Myrica Faya*, Ait.); but *Pinus Pinea* is planted in the islands.

SOUTH AMERICA.

Though without forests on the south-east, South America begins to be a timber-producing continent in the islands of the extreme south, where "Cipre" (*Libocedrus tetragona*) is largely felled; whilst north of the Straits of Magellan *Fagus antarctica*, the "Chilian beech," *F. Forsteri*, and *Drimys Winteri*, "Winter's bark," are abundant. In the inner valleys of the Chilian Cordilleras there are extensive virgin forests of large timber trees; and the same is true of the upper part of the "Sierra" region of Peru and the "Montaña" region. *Podocarpus chilensis*, *Thuja chilensis*, and *Araucaria imbricata*, the well-known Chili pine, may be mentioned as characteristic of the southern area—"Lambras" (*Alnus acuminata*), "Sauco" (*Sambucus peruviana*), "Queñuar" or "Oliva silvestre" (*Buddleia incana*), "Paccay" (*Inga*, sp.), from the sub-tropical Sierras round Lake Titicaca; and the *Chinchona*, *Erythroxylon Coca*, and rubber-yielding species of *Hevea*, from the Montaña region of the Eastern Andes. The scraggy "Algarrobo" (*Prosopis horrida*), and the willow (*Salix Humboldtiana*) of the Peruvian valleys, cannot rank as timber-trees; nor is timber an article of export; but the Montaña region is practically continuous with the interior of Brazil.

Brazil.

The Brazilian empire possesses virgin forests covering an area half the size of Europe; and no less than 300 kinds of useful timber were sent from them to the Paris Exhibition of 1873. Many of these are not yet well known to botanists; but there is in the

Botanical Department of the British Museum a manuscript volume by the late John Miers, F.R.S., many years resident in the country, entitled, "A Catalogue of the Woods of Brazil; Arranged Alphabetically after their Vernacular Names, their Localities, Dimensions," . . . in which many of them are botanically identified. "Mattas," or heavy forests, cover the immense humid lowland of Northern Brazil, and occur in belts in the plains of the central and southern portions of the empire; whilst the deciduous woods of the mountain slopes are known as "Catingas." Language altogether fails to picture the luxuriance of the vegetation of equatorial Brazil. Among the most valuable timbers of Brazil are—*Cæsalpinia echinata*, "Brazil wood;" "Braziletto wood," or "Ibiripatanga," which is hard and heavy, and takes a polish, but is largely used as a red dye; *C. ferrea*, "iron-wood;" *Dalbergia nigra*, "Jacaranda," or "Rosewood," the best of the genus, together with *D. latifolia*; *Cedrela brasiliensis*, the "cedar" of South Brazil; *Araucaria brasiliensis*, the pine of the Organ Mountains; *Mimusops alata*, the "cow tree," or "Massaranduba" of Para; *Physocalymma floribunda* (nat. order, *Lythraceæ*), the "tulip-wood;" *Lecythis Ollaria*, the sapucaya-nut; *Bertholletia excelsa*, the Brazil-nut; *Ocotea major*, "Puchury;" *Persea gratissima*, the "Avocado," or "Alligator pear;" *Avicennia*, the "White mangrove," the bark of which is used in tanning; and the numerous palms, of which *Copernicia cerifera*, the "Carnauba," "Wax palm," is the most valuable. But, rich in timber, the Brazilian forests are still richer in rubbers, gums, resins, dyes, and medicinal substances,—*Siphonia elastica* and *Hancornia speciosa* being among the chief rubber trees; *Maclura tinctoria* yielding fustic, and *Bixa Orellana*, arnatto.

French Guiana.

Clothed with dense forests, French Guiana produces many valuable timber trees. Among the *Leguminosæ* are—

Coumarouna odorata, Aubl. "Gayac," "Cuamara," or "Tonka bean" (= *Dipteryx*).

**Hymenæa Courbaril*, L. "Courbaril," or "Locust tree."

**Dicorynia paraensis*. "Angélique" (=*Andira inermis*). An important dockyard timber.

Copaifera bracteata. "Bois violet," or "Amaranthe."

Eperua falcata, Aubl. "Pois sabre," or "Wapa."

Andira Aubletii, Benth. "Wacapon," or "Épi de blé."

Robinia Panacoco. "Saint Martin;" and

Machærium Schomburghii. "Tiger-wood."

Among the *Myrtaceæ* are—

Psidium pomiferum. "Guava."
Courateri guianensis.
Lecythis grandiflora, Aubl.
L. Ollaria, L., etc.

Among the *Sapotaceæ* are—

**Mimusops Balata.* "Balata."
Lucuma Rivicoa. "Jaune d'œuf."
L. Bonplandii. "Bartaballi."

Among the *Laurineæ* are—

Nectandra Pisi. "Black cedar."
Licaria guianensis (=*Dicypellium caryophyllatum*, Nees). "Licari," "Clove Cassia of Brazil," "Rose of Cayenne," "Pepper-wood," and "Bois canelle."

Among the *Burseraceæ* are—

Bursera gummifera. "American gum tree," "Chibon."
Icica altissima, Aubl. "Cedar," "Carana gum."
I. guianensis. "Incense-wood."
I. elemigera. "Elemi tree;" and
I. Aracouchini, both yielding a medicinal gum.

Other trees are *Duguetia quitarensis*, Benth. (nat. order, *Anonaceæ*), the "lancewood;" *Carapa guianensis*, "Crabwood;" *Omphalobium Lamberti* (nat. order, *Connaraceæ*), "zebra-wood;" and the nutmegs, *Myristica fatua* and *sebifera.*

Dutch Guiana.

Though its resources are still undeveloped, there are in the primeval forests, which cover the greater portion of Surinam, many valuable species of timber. Among them are—

Bombax Ceiba. "Kankan." (*Bombaceæ.*)
Copaifera bracteata, L. "Purpuurhart." (*Leguminosæ.*)
Goupia tomentosa. "Kopie." Used for flooring.
Hymenæa Courbaril, L. "Locust," or "Courbaril." 60 to 80 feet, and 8 to 9 feet diameter. Brown, hard wood, taking a polish, and suitable for furniture. Exudes a gum. (*Leguminosæ.*)
Lecythis Ollaria, L. "Barklak." Worm-proof. (*Myrtaceæ.*)
Lucuma mammosum. "Bolletrie," "Paardenfleesch." (*Sapotaceæ.*)
Nectandra Rodiæi, Schomb. "Geelhart." (*Lauraceæ.*)
Vouacapoua americana, Aubl. "Bruinhart."

British Guiana.

The forests of Demerara, which cover the greater part of the

country, contain hundreds of species of timber trees, suitable for almost every purpose, growing together in a mixed virgin forest. The kinds most used in the colony are—for building, "greenheart," "mora," and "wallaba;" and for furniture, "crabwood." These timbers are almost imperishable, resisting damp and vermin, and can be readily brought to market. Among the chief sorts determined are—

Aspidosperma excelsum. "Wheel-tree," "Paddle-wood," "Yarooro"? (*Apocynaceæ.*)

Anacardium rhinocarpus. "Hooboodie," "Wild Cashew." Not durable. Fruit and bark medicinal. (*Anacardiaceæ.*)

Brosimum Aubletii, Poep. (= *Paratinera guianensis,* Aubl.). "Buro-koro." "Letter-wood," "Leopard" or "Snake-wood." (*Artocarpaceæ.*) Specific gravity, 1·333.

**Carapa guianensis,* Aubl. "Caraba," "Crabwood." Bark used in tanning; seeds yield crab oil. (*Meliaceæ.*)

Caryocar tomentosum, DC. "Souari" or "Pekea," "Butter-nut." (*Rhizobolaceæ.*) Specific gravity, ·932.

Coumarouna odorata, Aubl. (= *Dipteryx*). "Cuamara," "Tonkin bean." Cogs, etc. Hard, durable; oil from seeds. (*Leguminosæ.*)

Copaifera pubiflora and *C. bracteata,* Benth. "Kooroobovilli," "Purple heart." Handsome furniture wood. (*Leguminosæ.*)

**Eperua falcata,* Aubl. "Wallaba." Dark red. Or *E. rubiginosa,* Miq. (*Cæsalpiniceæ.*) Bark febrifuge.

**Hymenæa Courbaril,* L. "Simiri," "Locust." (*Leguminosæ.*) Yields "Gum animi" or "Locust gum."

Humiria floribunda, Mart. "Tawaronero," "Bastard bullet-tree." Good dark brown furniture wood. (*Humiriaceæ.*)

Icica altissima, Aubl. "Kurana," "Cedar." Very valuable. (*Burseraceæ.*)

Ixora triflorum, Benth. and Hook. fil. (= *Sidcrodendron*). "Hackia." Good dark brown furniture wood, equal to "lignum-vitæ." (*Rubiaceæ.*)

Lecythis grandiflora, Aubl. "Wadadura," "Monkey-pot." Fine oil from edible nuts. (*Myrtaceæ.*)

L. Ollaria, L. "Kakaralli." Takes a polish.

Machærium, sp. "Itikiboura-Balli." Inlaying, etc.; very heavy. (*Leguminosæ.*)

Maclura tinctoria, Don. "Fustic." Inlaying and dyeing. (*Urticaceæ.*)

**Mimusops globosa,* Gaertn. "Bullet tree," "Buruch," "Balata" gum. (*Sapotaceæ*) (= *Sapota Mulleri,* Miq.). Oil from seeds.

**Mora excelsa,* Benth. "Mora." Furniture, ship-building; bark in tanning, and medicinal. (*Leguminosæ.*) Sp. gr. = 1·029.

**Nectandra Rodiæi,* Schomb. "Bibiru," "Sipiri," "Greenheart." Bark yields Bebeerine, febrifuge, and tonic. Sp. gr., 1·210. (*Lauraceæ.*)

N. sp. "Waibaima," "Ciroua-Balli." More valuable than *N. Rodiæi.*

N. sp. "Lallifer," "Ciroua-Balli."

Omphalobium Lamberti, DC. "Hiawa-Balli," "Zebra-wood." Handsome furniture wood. (*Connaraceæ.*)

Ophiocaryon paradoxum. "Snake-nut." Suitable for furniture. (*Sabiaceæ.*

Simaruba officinalis. "Simarupa." Medicinal. (*Simarubeæ.*)

Picramnia, sp. "Curuberanda," "Bitter-wood." (*Simarubeæ.*)

Pentaclethra filamentosa, Benth. "Kooroo-Balli," "Trysil." Dark, suitable for furniture; bark medicinal. (*Leguminosæ.*)

Lucuma Bonplandii (=*Achras mammosa*, Bonpl.). "Bartaballi." (*Sapotaceæ.*)

Vochysia guianensis, Aubl. "Eta-Balli." (*Vochysiaceæ.*)

Trinidad.

Not technically belonging to the West Indies, Trinidad possesses a rich tree flora, of which the Kew Museum contains a representative series from the Exhibition of 1862. Among them are:—

**Achras Sapota*, L. "Sapodilla" or "Nispero." A large tree, with edible fruit, and very hard, heavy, and durable wood, sometimes known as "Bullet" or "Bully wood." (*Sapotaceæ.*)

Acrocomia sclerocarpa. "Gru Gru," "The great macaw tree." (*Palmaceæ.*) Walking-sticks; oil from nuts.

Astronium obliquum, Griseb. "Yoke Yopo." (*Melastomaceæ.*)

Avicennia tomentosa, Jacq. "Mangle chine." (*Verbenaceæ.*)

Brysonima spicata, Rich. "Surette." Bark used in tanning; wood not durable. (*Malpighiaceæ.*)

**Calophyllum Calaba*, Jacq. "Galba," "Palo Maria," "Santa Maria wood." (*Guttiferæ.*)

**Carapa guianensis*, Aubl. "Crabwood." (*Meliaceæ.*)

Cassia spectabilis, DC. "Casse." Dark, strong wood. (*Leguminosæ.*)

**Citharexylon quadrangulare*, Jacq. "Fiddle wood." (*Verbenaceæ.*)

**Chlorophora tinctoria*, Gaud., var. *Xanthoxylon*, End. "Fustic," "Palo Marango." (*Moreæ.*)

Coccoloba, sp. "Cuchape." Hard. *C. latifolia.* "Stave-wood." (*Polygonaceæ.*)

**Cocos nucifera*, L. "Porcupine-wood." For inlaying. Nuts, fibre, etc. (*Palmaceæ.*)

Euterpe oleracea, Mart. "Manaque." (*Palmaceæ.*) Flooring.

**Guaiacum officinale*, L. "Lignum-Vitæ." (*Zygophyllaceæ.*)

Genipa Caruto, Kth. "Genipa." Flexible. Shafts. (*Rubiaceæ.*)

Hippomane Mancinella, L. "Manchineel." Ship-building. (*Euphorbiaceæ.*)

Hirtella silicea, Griseb. "Cauto."

**Hymenæa Courbaril*, L. "Locust." (*Leguminosæ.*)

Laurinea, spp. "Laurier" and "Laurier Caca." Valuable for building.

Lecythis Idatimon, Aubl. "Guatecare." Elastic, durable. (*Myrtaceæ.*)

Licania, sp. "Gasparillo." (*Rosaceæ.*)

Malpighiacea, sp. "Cacapoule." Durable and strong.

Maximiliana insignis, Mart. "Cocorite." (*Palmaceæ.*)

**Mimusops globosa*, Gaertn. "Balata." (*Sapotaceæ.*)

**Mora excelsa*, Benth. "Mora." 100 to 150 feet, 24 to 30 inches diameter. Hard, durable, dark brown wood, for ship-building. (*Leguminosæ.*)

Myrtacea, sp. "Wild Guava." (*Psidium*, sp. ?) Durable.
**Peltogyne paniculata*, Benth. "Zapateri," "Purple-heart." Very durable.
Pentaclethra filamentosa, Benth. "Bois Mulatre," "Palo Mulato." (*Leguminosæ.*)
Rubiacea, sp. "Yema de Hueva."
Ruprechtia, sp. "Avocat." (*Polygonaceæ.*)
Sabal, sp. "Carat." (*Palmaceæ.*) Hard and durable.
Sacoglottis amazonica, Mart. "Cajon de Burro." (*Humiriaceæ.*)
Swartzia grandiflora, W. "Naranjillo amarillo." (*Leguminosæ.*)
Tamarindus indica, L. "Tamarind." (*Leguminosæ.*)
**Tecoma serratifolia*, Don. "Poni." (*Bignoniaceæ.*)
Thevetia neriifolia, Juss. "Quashy Quasher." (*Apocynaceæ.*)
Trichilia trinitensis, Juss. "Naranjillo blanco." (*Meliaceæ.*) And
**Vitex capitata*, V. "Bois Lezard." Strong and durable. (*Verbenaceæ.*)

Among 211 varieties of timber trees reported on by the Surveyor-General of the island in 1876, no less than 55 furnish timber adapted for boat-building, though none is exported. Other sorts of hardwood enumerated are **Sideroxylon masticodendron*, "Acoma," or "Mastick;" **Andira inermis*, "Angelin;" **Rhopala montana*, "Beefwood;" **Cedrela odorata*, "Cedar;" *Chuncoa obovata*, "Olive;" **Piptadenia peregrina*, "Yoke;" *Calycolpus ovalifolius*, "Monkey Bones;" and *Pimenta acris*, "Pimento."

Of these woods, of which the most valuable are marked with an asterisk, many occur in the other islands of the West Indies.

Venezuela.

In the manuscript volume by John Miers, already referred to, is the following list of the vernacular names of nearly 200 specimens, illustrating about 140 woods sent from Venezuela to the Exhibition of 1862, to most of which scientific names have been added. It is much to be wished that this volume should be published in its entirety. The first 82 have specific gravities appended, the list being printed as it stands in the original manuscript.

1. Granadilla, . . .	1·2367.	*Couroupita odoratissima*, Seem.
2. Nazarene, . . .	1·1744.	*Hymenæa floribunda.*
3. Dividivi (=152), . .	1·2189.	*Cæsalpinia coriaria.*
4. Palma real, . . .	1·0787.	*Orcodoxa regia.*
,, ,, . . .	. .	*Cocos butyracea.*
5. Fiama, ...	1·3003.	
6. Araguaney, . . .	1·0985.	
7. Guayacan (=158), . .	1·3068.	*Tecoma Guayacan*, Seem.

8.	Gateado (=107,119,128,159),	1·0034.	*Acacia riparia ?*
9.	Cartan (from the hot country),	0·8171.	
10.	Urape negro, . . .	0·3577.	*Bauhinia (Pauletia) multinervia.*
11.	Guayabo encarnado, . .	1·0946.	*Psidium.*
12.	Urape rosado, . . .	0·9842.	*Bauhinia (Pauletia) glandulosa.*
13.	Hayo (Guayo colorado ?), .	1·1107.	*Acacia peregrina.*
14.	Vera (Uvero ?), . . .	1·2479.	*Coccoloba Caracasana.*
15.	Guayabo rosado, . .	1·0206.	
16.	Cana fistola, . . .	0·8575.	*Cassia Brasiliensis.*
17.	Guayabo blanco, . .	1·0503.	
18.	Nogal, ...	0·5587.	
19.	Majomo, ...	0·8434.	
20.	Roble, ...	0·8758.	*Tecoma pentaphylla.*
21.	Guyabo pauji, . . .	1·0244.	*Bumelia buxifolia ?*
22.	Naranjo dulce, . . .	0·8015.	*Citrus aurantium.*
23.	Huecito, ...	1·0019.	
24.	Zapaten, ...	0·9311.	*Hymenæa venosa ?*
25.	Guayabo racino, . .	1·0715.	
26.	Tijerita, ...	0·8301.	
27.	Angelino, ...	0·8186.	*Andira inermis.*
28.	Naranjillo, . . .	0·8586.	*Swartzia triphylla ?*
29.	Paraguatan, . . .	0·8026.	*Condaminia tinctoria*, DC.
30.	Laurel Angelino, . .	0·5505.	*Nectandra Laurel.*
31.	Pardillo negro, . . .	0·7017.	
32.	Toco, ...	0·6099.	*Cratæva gynandra.*
33.	Cartan (cold country), .	0·7537.	(=9).
34.	Olivo (99, 174), . .	0·6213.	*Capparis intermedia*, H.B.K.
35.	Coba longa, . . .	0·8911.	
36.	Cedro dulce, . . .	0·5293.	*Cedrela odorata.*
37.	Guarataro (77), . . .	0·7950.	*Courateri Guianensis.*
38.	Capuchino, . . .	0·6280.	
39.	Cedro amargo, . . .	0·2579.	*Simaba cedron.*
40.	Caimito (145), . . .	1·0869.	*Chrysophyllum Caimito*, L.
41.	Grifo, ...	0·8017.	
42.	Lecherito, . . .	0·9877.	*Brosimum ?*
43.	Laurel mangon, . .	0·6818.	
44.	Estoragne (154), . .	0·8482.	*Styrax tomentosum*, H.B.K.
45.	Guama, ...	0·6058.	*Inga Bonplandiana.*
	,, ...		*Inga vera.*
46.	Laurel Aguacate, . .	0·5885.	*Persea gratissima.*
47.	Almendro, . . .	0·8771.	*Geoffroya superba.*
48.	Lecherito pintado, . .	0·7770.	
49.	Aguanoso, ...	0·5628.	
50.	Sereipo, ...	0·7668.	*Avicennia nitida.*
51.	Croton, ...	0·4500.	*Croton coriaceus ?*
52.	Cedrillo horcon, . .	0·6557.	
53.	Tigron, ...	1·0151.	
54.	Cerezo, ...	1·0260.	*Bunchosia glauca.*
55.	Atata, ...	1·0271.	

56.	Tabacote,	0·5227.	
57.	Tasi (Techi ?),	1·2432.	*Myroxylon pubescens ?*
58.	Naranjillo,	1·0207.	*Swartzia tomentosa*, DC.
59.	Limoncillo,	0·9183.	*Citrosma laurifolium.*
60.	Chupon colorado,	1·0169.	*Gustavia* or *Perigara speciosa.*
61.	Guisanda,	0·9719.	
62.	Narauli,	0·8239.	
63.	Guayabo sabonero,	1·0265.	
64.	Roseta,	0·8821.	
65.	Chupon,	0·9461.	*Gustavia fastuosa ?*
66.	Espuelita,	0·9473.	*Inga microphylla.*
67.	Sassafraz,	0·7313.	*Nectandra cymbarum.*
68.	Rosa de montaña,	0·8477.	*Brownea grandiceps.*
69.	Canella de venado,	0·7646.	
70.	Apamate,	0·6443.	
71.	Lechoso,	0·7864.	
72.	Curtidor,	0·8719.	
73.	Pinabete,	0·5825.	
74.	Haya criolla,	0·7832.	*Rhopala polystachya ?*
75.	Guamo,	0·8921.	*Inga insignis.*
76.	Pui,	1·0194.	
77.	Guarataro (37),	0·8777.	*Courateri Guianensis.*
78.	Llagnero.		
79.	Aguacate Cimaron,	0·5337.	*Persea*, sp. ?
80.	Aguacate dulce,	0·521.	*Persea gratissima.*
80*.	Cuji (91),	1·0538.	*Inga cinerea.*
81.	Balsamillo,	0·8533.	*Elaphrium Jacquinianum ?*
82.	Amarillo,	0·8591.	*Xanthoxylum Cumanense ?*
83.			
84.	Alcornoquio (132),		*Bowdichia Virgilioides.*
85.	Apamate.		
86.	Asajarito.		
87.	Caoba (139, 126),		*Swietenia Mahogani.*
88.	Caritiva (141),		*Prosopis.*
89.	Cotoperis,		*Myrtus erythroxyloides.*
90.	Cuchara (124),		*Oreocallis grandiflora ?*
91.	Cuji (80),		*Inga cinerea.*
92.	Curarire (143),		*Lasiostoma Curcire*, H.B.K.
93.	Ebano (153),		*Brya Ebenus*, DC.
94.	Flor amarilla (155).		
95.	Guiamarè (157).		
96.	Guayavo (156),		*Psidium pyriferum.*
97.	Hatata.		
98.	Lata (160).		
99.	Olivo (34, 174),		*Capparis intermedia.*
100.	Pardillo (177).		
101.	Vera (14, 123),		*Coccoloba caracasana.*
102.	Virote.		
103.	Canalete (146).		

104. Cedro (150), ... *Cedrela odorata.*
105. Roble (20), ... *Tecoma pentaphylla.*
106. Zapatero (24), ... *Hymenæa venosa.*
107. Gateado (8, 119, 159), . . . *Acacia riparia?*
108. Mamon de venado, ... *Milicoca*, sp. ?
109. Paraguatan (29), ... *Condaminia tinctoria.*
110. Trompillo, ... *Lactia guazumæfolia.*
111. Gateado amarello, ... *Acacia*, sp. ?
112. Canafistola du lemana santa, . . *Cassia Brasiliana?*
113. Canafistola Marimari, . . . *Cassia Bonplandiana.*
114. Mosa (Palo de Mozo ?), . . . *Machærium*, sp.
115. Araguanci (6).
116. Algarrobo, ... *Hymenæa Courbaril.*
117. ,, ... *Prosopis pallida.*
118. Chinca.
119. Gateado (8, 107, 159), . . . *Acacia riparia?*
120. Chica, ... *Lundia Chica.*
121. Tussara.
122. Betun.
123. Vera (14, 101), ... *Coccoloba caracasana.*
124. Cucharo (90), ... *Orcocallis grandiflora.*
125. ?
126. Caobo (87, 139), ... *Swietenia Mahogani.*
127. Maçanilla, ... *Hippomane Mancinella*, L.
128. Gateado (8, 107, 119, 159), . . *Acacia riparia.*
129.
130. Amargo, ... *Simaruba glauca?*
131. Accituno, ... *Calophyllum longifolium?*
132. Alcornoquio (84), ... *Bowdichia Virgilioides.*
133. Balaustre.
134. Brazil, ... { *Coulteria tinctoria,* / *Poinciana insignis.*
135. Balsamo, ... *Myrospermum toluiferum.*
136. Cuji (81, 91), ... *Inga cinerea?*
137. Clemon.
138. Ceiba, ... *Eriodendron anfractuosum*, DC.
139. Caoba (87, 126), ... *Swietenia Mahogani.*
140. Canjaro.
141. Caritiva (88), ... *Prosopis*, sp.
142. Canada.
143. Curarire (92), ... *Lasiostoma curari*, H.B.K.
144. Caobilla.
145. Caimito (40), ... *Chrysophyllum Caimito.*
146. Canalete (103).
147. Carangano.
148. Cardon.
149. Carrato.
150. Cedro (104), ... *Cedrela odorata.*
151. Daguero.

152. Dividivi (3), ... *Cæsalpinia coriaria*, L.
153. Ebano (93), ... *Brya Ebenus*, DC.
154. Estorague (44), ... *Styrax tomentosum*, H.B.K.
155. Flor amarello (94).
156. Guayabo (96), ... *Psidium pyriferum.*
157. Guaimaro (95).
158. Guayacan (7), ... *Tecoma Guayacan*, Seem.
159. Gateada (8, 107, 119), . . . *Acacia riparia ?*
160. Lata (98).
161. Llalla.
162. Mocquillo, ... *Moquilea Guianensis*, Aubl.
163. Marfil, ... *Phytelephas macrocarpa.*
164. Membrillo (166), ... *Gustavia superba.*
165. Moral, ... *Mora excelsa.*
166. Membrillo (164), ... *Gustavia angustifolia ?*
167. Maria, ... *Triplasis caracasana*, Cham.
168. Macarutu.
169. Mecoque.
170. Mamon, ... *Melicocca bijuga.*
171. Mangle blanco, ... *Odontandra acuminata.*
172. Mangle colorado, ... *Avicennia tomentosa.*
173. Olla de Mono, ... *Lecythis Ollaria.*
174. Oliva (34, 99), ... *Capparis intermedia.*
175. Panjil.
176. Penda.
177. Pardillo (100).
178. Quiebrahacha, ... *Cæsalpinia ?*
179. Roble (20), ... *Tecoma pentaphylla.*
180. Vera (14, 101, 123), . . . *Coccoloba caracasana ?*
181. Zapatero (24), ... *Hymenæa venosa ?*
182. Hoja ancha, ... *Nectandra polyphylla ?*

In spite of its various duplicate entries and uncertain identifications, I have thought it best to transcribe this manuscript verbatim.

Ecuador.

Possessing extensive forest resources, the character of the woodlands of Ecuador varies strikingly with altitude. Pines occur even above 9200 feet, as in the Mexican highlands, between which level and 5500 feet there are oak, elm, ash, and beech. At lower levels we have many palms, "Brazil-wood," "ebony," "cedar," and other species not well known botanically.

Honduras.

The following list of the chief timber trees of Honduras (inde-

pendent) was drawn up in 1874 by Mr J. F. Debrot, British Vice-Consul at Omoa and Puerto Cortés :—

Acacia proxima. English, "Savicer;" Spanish, "Sisileon." Heavy, red, durable. Used for sleepers, building, and naval purposes. (*Leguminosæ.*)

A. vera. "Acacia," "Espino." Firewood. Yields gum arabic.

Achras Sapota, L. "Sapodilla," "Nispero." Hard, dense, red, durable, Building. (*Sapotaceæ.*)

Amerimnum ebenus, Sw. "Billyweb," "Chichipate." Tough, elastic, durable. Resembling "lignum-vitæ." (=*Brya Ebenus,* DC. *Leguminosæ.*)

Amyris balsamifera, L. "Rosewood," "Granadillo" or "Funera." Resinous, aromatic, veined. Furniture. Exported. (*Burseraceæ.*)

Bombax Ceiba, L. "Cotton tree," "Ceiba." Light, soft, not very durable. (*Bombaceæ.*)

Cæsalpinia echinata. "Nicaragua" or "Lima" wood, "Brazil." Dyeing. Exported. (*Leguminosæ.*)

Cedrela odorata, L. "Cedar," "Cedro." Furniture and building. Exported. (*Meliaceæ.*)

Coccoloba uvifera, Jacq. "Sea-side grape," "Uva de Costa." Red, hard, durable. Turning, building, etc. (*Polygonaceæ.*)

Conocarpus racemosus, L. "White mangrove," "Mangle blanco." White. Interior of buildings. (*Combretaceæ.*)

Guarea trichilioides, Gr. "Bullet-tree," "Palo de Bala." Brown, hard, durable. Building. (*Meliaceæ.*)

Guatteria virgata, Dun. "Lancewood," "Yaya." Yellow, elastic. Shafts, bows and arrows. (=*Oxandra virgata,* Rich. *Anonaceæ.*)

Guettarda speciosa, L. "Zebra wood," "Ronron." Striped. Turnery and cabinet work. Exported. (*Rubiaceæ.*)

Heisteria coccinea, Jacq. "Cabbage" or "Partridge tree," "Cabiche." Hard, brown, durable wood. Cabinet work, ship-building, sleepers, etc. (*Olacineæ.*)

Laurus Persea, Sw. "Alligator pear," "Aguacate." Durable brown wood, but grown for fruit. (*Lauraceæ.*)

Laurus, sp. "Camphor wood," "Laurel." Very durable. Posts, sleepers, etc.

Maclura tinctoria, Don. "Fustic." Dye. Exported. (*Moreæ.*)

Mora excelsa, Benth. "Mora." Teak substitute. Exported. (*Leguminosæ.*)

Pinus australis, Michx. "Pine," "Ocoté." Yellow or pitch pine. Piles and ship-building. (*Coniferæ.*)

Pterocarpus Draco, L. "Dragon tree," "Sangre drago." Soft, cedar-like wood, durable if dry. Dragon's-blood exudes from the bark. (*Leguminosæ.*)

Quercus Robur, L. "Oak," "Roble." Building. (*Cupuliferæ.*)

Q. virens, Ait. "Live oak," "Encino." Sleepers, etc.

Rhizophora decandra. "Red mangrove," "Mangle colorado." Red, hard, elastic, durable wood. Building. (*Rhizophoraceæ.*)

R. Mangle, L. "Black mangrove," "Mangle negro." Darker, denser, heavier. Piles, sleepers, etc.

Swietenia Mahagoni, L. "Mahogany," "Caoba." Variable in quality. Bark used in tanning. Furniture and building. Largely exported. (*Meliaceæ.*)

Other species not yet accurately determined are "Santa Maria," resembling mahogany, much used and exported, probably *Calophyllum Calaba*, Jacq.; "Yellow-wood," "Panjuil," resembling box; "San Juan," also yellow, extensively used in building; "Iron-wood," "Axemaster" or "Quiebra Hacha," not much used on account of its hardness; "Redwood," "Jabon," very durable, used in building; "Wild hazel," "Avellano," resembling the hazel; and "Balsam," "Balsamo," a hard red wood, used for rollers in sugar mills.

British Honduras.

It is remarkable that the trees of this colony, yielding as it does such invaluable species as mahogany (*Swietenia Mahagoni*, L.) and logwood (*Hæmatoxylon campechianum*, L.), should not be more thoroughly ascertained than they are. They include

Cedrela odorata, L. "Cedar." (*Meliaceæ.*)
Maclura tinctoria, Don. "Fustic." (*Moreæ.*)
Achras Sapota, L. "Sapodilla" or "Bully." (*Sapotaceæ.*)
Mimosa, sp. "Braziletto" (= *Cæsalpinia brasiliensis?*). (*Leguminosæ.*)
Hibiscus, sp. "Mahoe" (= *Paritium elatum*, Dow. ?). (*Malvaceæ.*)
Terminalia, sp. "Red mangrove" (= *Rhizophora decandra?*).

"Rosewood," "Pitch Pine," "Santa Maria," "Dogwood," "Lignum-Vitæ," "Wild Tamarind," "Samwood," "Black" and "White Mangrove," and "Button-wood." Since 1865 mahogany, "cedar," and "logwood" are the only species exported. [Wray, "Journ. Soc. Arts" (1859), vii., 428, and "Forestry and Forest Products," Edinburgh (1885), p. 386.]

Cuba.

Provided with extensive, varied, and valuable forests, especially in the central and eastern parts, Cuba exports but little timber; and even uses imported American pine in its sea-ports, partly, no doubt, from the want of roads in the interior. The following list of the useful trees of the island, arranged under their local names, many of which have been tested by loading pieces, 1 square inch thick and about a yard in length, up to their breaking-point, is taken from one drawn up by Mr Francis A. Saurallef of Habana in 1874.

"Abran de Costa" (*Bunchosia nitida*, Juss. *Malpighiaceæ*). Sp. gr., ·972. Posts.

"Acana" (*Bassia albescens*, Griseb. *Sapotaceæ*). Sp. gr., 1·077. Breaks at 408 lbs. Violet, becoming dark. Door-posts, wheels, window-frames.

"Agalla" (*Bourreria calophylla*. *Boragineæ*). Sp. gr., ·797. Yokes for oxen.

"Agracejo de Monte" (*Cascaria eriophora*. *Samydeæ*). Sp. gr., ·877. Excellent for house-frames.

"Aguacate" (*Persea gratissima*, Gärtn. *Lauraceæ*). Sp. gr., ·661. Grown for fruit.

"Aguacatillo" (*Oreodaphne leucoxylon*, Nees. *Lauraceæ*). Greenish wood for internal work.

"Alamo" (*Ficus religiosa*, Willd. *Urticaceæ*). Sp. gr., ·671. Fruit for swine and cattle.

"Algarrobo" (*Pithecolobium Saman*, Benth. *Leguminosæ*). Sp. gr., ·514. Hard.

"Almacigo" (*Bursera gummifera*, L. *Burseraceæ*). Sp. gr., ·330. Hedges. Seeds for pigs.

"Almendrillo" (*Rhamnidium revolutum*, Wr. *Rhamnaceæ*). Sp. gr., ·883. Building.

"Almendro" (*Laplacea curtyana*, Rich. *Camelliaceæ*). Sp. gr., ·680. Breaks at 547 lbs. Hard, compact, flexible, yellow. Tool-handles and beams.

"Arabo colorado" (*Erythroxylon obovatum*, L. *Erythroxylaceæ*). Sp. gr., 1·088. Building.

"Ateje" (*Cordia collococca*, L. *Cordiaceæ*). Sp. gr., ·618. Interior work in building.

"Atejillo" (*C. nitida*, L.). Similar.

"Baria" (*C. gerascanthoides*, Kunth.). Sp. gr., ·841. Breaks at 354 lbs. Elastic, light green with white veins.

"Bayito" (*Hœnianthus salicifolium*, Griseb. *Oleaceæ*). Sp. gr., 1·252. Very hard. Building.

"Boje" (*Maytenius buxifolium*, Griseb. *Celastraceæ*). Roofing.

"Boniato amarillo" (*Nectandra exaltata*, Griseb. *Lauraceæ*). Interior work.

"Cacalote" (*Lebedibia pinnata*, Griseb. *Leguminosæ*). Black dye.

"Café cimarron" (*Faramea odoratissima*, DC. *Rubiaceæ*). Sp. gr., ·697. Walking-sticks.

"Caimitillo" (*Chrysophyllum olivæforme*, Lamk. *Sapotaceæ*). Sp. gr., ·987. Breaks at 469 lbs. Hard, compact, and elastic. Hoops, etc.

"Caimito" (*C. Caimito*, L.). Sp. gr., ·597. Similar.

"Cazuela" (*Hieronyma clusioides*, Griseb. *Euphorbiaceæ*). Building.

"Campeche" (*Hœmatoxylon campechianum*, L. *Euphorbiaceæ*). Sp. gr., ·995. Dyeing.

"Canistel" (*Lucuma nervosa*, Griseb. *Sapotaceæ*). Roofing, etc.

"Caoba" (*Swietenia Mahagoni*, L. *Meliaceæ*). Sp. gr., ·880. Breaks at 268 lbs. Furniture, etc.

"Carne doncella" (*Byrsonima lucida*, Rich. *Malpighiaceæ*). Sp. gr., ·665. Mill-wheels, posts, etc.

"Cedro" (*Cedrela odorata*, L. *Meliaceæ*). Sp. gr., ·626. Breaks at 300 lbs. Worm-proof, durable.

"Ceiba" (*Eriodendron anfractuosum*, DC. *Bombaceæ*). Sp. gr., ·287. Soft, white. Canoes.

"Cerillo" (*Exostemma Caribæum*, R. & V. *Rubiaceæ*). Hard, yellow. Walking-sticks.

"Chicharron" (*Chuncoa chicharronia*, Griseb. *Combretaceæ*). Sp. gr., ·979. Breaks at 430 lbs. Hard, tough, durable, grey wood. Ribs of ships.

"Chuichona" (*Exostemma floribundum*, R. S. *Rubiaceæ*). Building.

"Cocuyo" (*Bumelia cuneata*, Swartz. *Sapotaceæ*). Sp. gr., 1·157. Brown, veined; not durable. Posts.

"Cordovancillo" (*Miconia Rangeliana*, Wr. *Melastomaceæ*). Posts.

"Cuaba," or "Torch-tree."

"Cuajani" (*Prunus occidentalis*, Swartz. *Rosaceæ*). Sp. gr., 1·051. Carts and building.

"Cuyá" (*Dipholis salicifolia*, DC. *Sapotaceæ*). Breaks at 382 lbs. Hard and elastic. Posts, piles, etc.

"Dagame" (*Callycophyllum candidissimum*, DC. *Rubiaceæ*). Sp. gr., ·893. Breaks at 441 lbs. Hard, compact, elastic, grey.

"Daguilla" (*Lagetta lintearia*, Lam. *Thymelaceæ*). "Lace-bark." Ropes from bark.

"Ebano Real" (*Diospyros tetrasperma*, Jacq. *Ebenaceæ*). Sp. gr., 1·300. Breaks at 305 lbs. Black, brittle, hard. Cabinet work.

"Frijolillo" (*Gliricidia platycarpa*, Griseb. *Leguminosæ*). Sp. gr., 1·068. Breaks at 410 lbs. Hard. Posts.

"Fustete" (*Maclura tinctoria*, Don. *Moreæ*). Breaks at 305 lbs. Yellow. Spokes, etc., and dyeing.

"Granadillo" (*Brya Ebenus*, DC. *Leguminosæ*). Sp. gr., 1·206. Breaks at 480 lbs. Black, inelastic, brittle. Cabinet-work.

"Guamá" (*Lonchocarpus sericeus*, Kunth. *Leguminosæ*). Sp. gr., ·644. Ropes from bark.

"Guamá de Costa" (*L. latifolius*, Kunth.). Sp. gr., ·946. Hard, compact, elastic. Posts, under water.

"Guao" (*Comocladia platyphylla*, Rich. *Terebinthaceæ*). Sp. gr., 1·161. Incorruptible. Hedges and posts.

"Guacima Baria" (*Luhea platypetala*, Rich. *Tiliaceæ*). Sp. gr., ·805. Interior work.

"Guayacan" (*Guaiacum officinale*, L. *Zygophyllaceæ*). Sp. gr., 1·274. Breaks at 246 lbs. Dark brown, veined; very dense. Posts, under water.

"Guayacancillo" (*Behainia cubensis*, Griseb. *Leguminosæ*). Sp. gr., 1·096. Posts. Fruit for pigs.

"Guira" (*Crescentia Cujete*, L. *Bignoniaceæ*). Sp. gr., ·580. Breaks at 243 lbs. Soft, elastic. Lasts, sieves, saddle-bows.

"Hueso" (*Drypetes glauca*, Poit. *Euphorbiaceæ*). Sp. gr., 1·020. Hard, white. Interior work.

"Jaimiqui" (*Mimusops Jaimiqui*, Wr. *Sapotaceæ*). Sp. gr., 1·088. Hard, elastic. Spokes, etc.

"Jaragna" (*Phialanthus myrtilloides*, Gr. *Rubiaceæ*). Breaks at 583 lbs. Hard, brownish white; everlasting.

"Jayajabico" (*Colubrina reclinata*, Dow. *Rhamnaceæ*). Hard, deep red.

"Jequi" (*Dipholis nigra*, Griseb. *Sapotaceæ*). Sp. gr., 1·268. Breaks at 354 lbs. Hard, dark brown streaked with black. Balustrades, posts, etc.

"Jocuma" (*Sideroxylon mastichodendron*, Jacq. *Sapotaceæ*). Sp. gr., 1·079. Hard, yellowish. All kinds of carpenter's work.

"Jucaro" (*Bucida capitata*, Dow. *Combretaceæ*). Sp. gr., ·893. Breaks at 398 lbs. Compact, grey. Carpenter's work, carts, etc.

"Jagua" (*Genipa americana*, L. *Rubiaceæ*). Sp. gr., ·896. Breaks at 314 lbs. Soft, compact, elastic, light brown. Lances, gun-stocks, etc.

"Lanero" (*Ochroma lagopus*, Swartz. *Bombaceæ*). Sp. gr., ·180.

"Majagna" (*Paritium elatum*, Dow. = *Hibiscus tiliaceus*, L. *Malvaceæ*). Sp. gr., ·722. Breaks at 394 lbs. Very flexible, bluish-green, quick-growing. Ropes from bark. In demand for gun-stocks, carriage-poles, ship-knees, etc.

"Manajú" (*Rheedia aristata*, Griseb. *Guttiferæ*). Sp. gr., ·929. Hard, resinous. Building.

"Mangle prieto" (*Avicennia nitida*, Jacq. *Verbenaceæ*). Sp. gr., 1·178. Breaks at 380 lbs. Hard, dark brown. Posts under water. Bark and leaves for tanning.

"Mangle colorado" (*Rhizophora Mangle*, L. *Rhizophoraceæ*). Sp. gr., 1·017. Tanning.

"Mate" (*Tobinia ternata*, Des. *Rutaceæ*). Sp. gr., 1·029. Hard, compact. Good for posts.

"Moruro-abey" (*Peltophorum adnatum*, Griseb. *Leguminosæ*). Sp. gr., ·999. Hard.

"Nogal criollo" (*Juglans insularis*, Griseb. *Juglandaceæ*). Sp. gr., ·797. Hard. Building.

"Ocuje" (*Calophyllum Calaba*, Jacq. *Guttiferæ*). Sp. gr., ·842. Breaks at 354 lbs. Flexible, orange yellow; veined. Masts and building.

"Ofon criollo" (*Vitex divaricata*, Swartz. *Verbenaceæ*). Sp. gr., ·769. Posts.

"Peralejo" (*Byrsonima crassifolia*, Kunth. *Malpighiaceæ*). Sp. gr., ·693. Hedges and tanning.

"Pico de gallo" (*Cynometra cubensis*, Rich. *Leguminosæ*). Sp. gr., ·927. Hard, durable.

"Piñon de cercas" (*Erythrina carnea*, Dow. *Leguminosæ*). Hedges.

"Piñon plumago" (*Gliricidia sepium*, Kunth. *Leguminosæ*). Hedges.

"Ramon" (*Trophis americana*, L. *Urticaceæ*). Sp. gr., 1·183. Walking-sticks. Leaves as fodder.

"Rasca barriga" (*Randia calophylla*, Griseb. *Rutaceæ*). Sp. gr., 1·028. Hard, flexible. Building.

"Roble blanco" (*Tecoma pentaphylla*, Juss. *Bignoniaceæ*). Sp. gr., ·834. Yokes and building.

"Roble guayo" (*Petitia Poppigia*, Schau. *Verbenaceæ*). Sp. gr., ·826. Posts.

"Roble de olor" (*Catalpa longisiliqua*, Griseb. *Bignoniaceæ*). Sp. gr., ·753. Very hard, incorruptible.

"Roble real" (*Tecoma longiflora*, Griseb. *Bignoniaceæ*). Sp. gr., ·900. Good for building.

"Sabicu" (*Leucæna formosa*, Griseb. = *Acacia formosa* = *Lysiloma Sabicu*. *Leguminosæ*). Sp. gr., ·957. Breaks at 435 lbs. Hard, elastic, brown. Sugar-mills.

"Sabina" (*Juniperus virginiana*, L. *Coniferæ*). Sp. gr., ·655. Everlasting.

"Tamarindo" (*Tamarindus indica*, L. *Leguminosæ*). Hard, brown, handsomely veined; takes a good polish. In demand for furniture.

"Tengue" (*Poppigia procera*, Pol. *Leguminosæ*). Sp. gr., ·924. Hard, yellow. Posts.

"Vera" (*Chione cubensis*, Rich. *Rubiaceæ*). Sp. gr., ·786. Roofing.

"Yaba" (*Andira inermis*, Kunth. *Leguminosæ*). Sp. gr., ·688. Breaks at 300 lbs. Hard, brown, veined; poisonous; indestructible under water or underground. Ship-building.

"Yaiti" (*Excæcaria lucida*, Su. *Euphorbiaceæ*). Sp. gr., 1·193. Very hard. Walking-sticks.

"Yamaquey" (*Pictitia angustifolia*, Griseb. *Leguminosæ*). Sp. gr., ·997. Breaks at 293 lbs. Hard, dark brown. Good for posts.

"Yana" (*Conocarpus erectus*, Kunth. *Combretaceæ*). Sp. gr., 1·008. Sleepers.

"Yanilla" (*Picrodendron Juglans*, Griseb. *Juglandaceæ*). Sp. gr., 1·184. Sleepers.

"Yaya" (*Oxandra virgata*, Rich. *Anonaceæ*). Sp. gr., 1·051. Breaks at 228 lbs. Hard, light, brown. Building.

Jamaica.

In 1873 Jamaica was estimated to contain 800,000 acres of timber, only 20,000 of which were in the hands of Government; whilst clearing was proceeding at the rate of 30,000 acres annually. The chief exported woods are logwood (*Hæmatoxylon campechianum*, L.), ebony or "Cocus-wood" (*Brya Ebenus*, DC.), lancewood (*Oxandra virgata*, Rich.), lignum-vitæ (*Guaiacum officinale*, L.), mahogany (*Swietenia Mahogani*, L.), candlewood (*Amyris*, sp.), and braziletto (*Cæsalpinia brasiliensis*), a valuable dye. The Jamaica mahogany is said to be harder and richer in grain than that of Honduras. The only gregarious trees in the island are logwood, "Cashaw" (*Prosopis juliflora*), and "bread-nut" (*Brosimum Alicastrum*; nat. order, *Moreæ*). The cashaw is valuable for piles and sleepers, and is the chief fuel. Other species are:—

Andira inermis, Kunth. (nat. order, *Leguminosæ*). "Bastard cabbage."

Amyris balsamifera, L. (nat. order, *Burseraceæ*). "Lignum Rhodium" or "Mountain Torchwood."

Brosimum Aubletii, Poep. (nat. order, *Artocarpaceæ*). "Letter," "Leopard," or "Snake" wood.

Calliandra [= *Pithecolobium*] *Saman*, Griseb. (nat. order, *Leguminosæ*). "South American Acacia" or "Algarob."

Calophyllum Calaba, Jacq. (nat. order, *Guttiferæ*). "Santa Maria."
Catalpa longisiliqua, Griseb. (nat. order, *Bignoniaceæ*). "Oak."
Ceanothus Chloroxylon, Ns. (nat. order, *Rhamnaceæ*). "Cogwood."
Cedrela odorata, L. (nat. order, *Meliaceæ*). "Cedar." Very useful.
Coccoloba uvifera, Jacq. (nat. order, *Polygonaceæ*). "Seaside Grape."
Comocladia integrifolia, Jacq. (nat. order, *Terebinthaceæ*). "Maiden plum."
Cordia Boissieri, A. DC. (nat. order, *Cordiaceæ*). "Anacahuite wood."
C. Gerascanthus, Sw. "Spanish elm."
Crataeva Tapia, L. (nat. order, *Capparidaceæ*). "Garlic tree."
Crescentia Cujete, L. (nat. order, *Bignoniaceæ*). "Calabash."
Hedwigia balsamifera, Sw. (nat. order, *Burseraceæ*). "Baume à cochon."
Juniperus barbadensis, L. (nat. order, *Coniferæ*). "Juniper cedar."
Lagetta lintearia, Lam. (nat. order, *Thymelaceæ*). "Lace-bark."
Laplacea Hæmatoxylon, Camb. (nat. order, *Camelliaceæ*). "Blood" or "Iron wood."
Laurus Chloroxylon, L. (nat. order, *Lauraceæ*). "Greenheart."
Linociera ligustrina, Sw. (nat. order, *Oleaceæ*). "Rosewood."
Maclura (= *Chlorophora*) *tinctoria*, Don. (nat. order, *Moreæ*). "Fustic."
Mammea americana, L. (nat. order, *Guttiferæ*). "Mammee apple."
Oreodaphne exaltata, Ns. (nat. order, *Lauraceæ*). "Jamaica sweetwood."
Paritium elatum, Dow. (nat. order, *Malvaceæ*). "Mahoe." Valuable.
Persea gratissima, Gärtn. (nat. order, *Lauraceæ*). "Pear," "Avocado."
Petitia domingensis, Jacq. (nat. order, *Verbenaceæ*). "Fiddlewood."
Picræna excelsa, Lindl. (nat. order, *Simarubaceæ*). "Quassia," "Bitter-wood."
Pimenta vulgaris, W. A. (nat. order, *Myrtaceæ*). "Pimenta."
Piscidia Erythrina, L. (*Leguminosæ*). "Dogwood."
Pithecolobium filicifolium, Benth. (nat. order, *Leguminosæ*). "Wild tamarind."
Podocarpus coriaceus, Rich., and *P. Purdieanus*, Hook. (nat. order, *Taxineæ*). "Yacca."
Prunus occidentalis, Swartz. (nat. order, *Rosaceæ*). "Pruan."
Psidium montanum, Sw. (nat. order, *Myrtaceæ*). "Mountain guava."
Sapota Sideroxylon, Gr. (nat. order, *Sapotaceæ*). "Naseberry Bully tree." Preferable even to the cedar.
Schæffera buxifolia, Nutt. (nat. order, *Ilicineæ*). "Jamaica box."
Sloanea jamaicensis, Hook. (nat. order, *Tiliaceæ*). "Break-axe."
Spondias lutea, Macf. (nat. order, *Anacardiaceæ*). "Hog plum."
Terminalia latifolia, Sw. (nat. order, *Combretaceæ*). "Broad leaf." An enormous tree. Timber suitable for planks and other internal works.
Ximenia americana, L. (nat. order, *Olacineæ*). "Yellow sanders." And
Zanthoxylum clava-Herculis, L. (nat. order, *Zanthoxylaceæ*). "Prickly yellow-wood."[1]

Leeward Islands.

There is no timber in Antigua; and little but lignum-vitæ,

[1] Mr Rogers' "Analysis of Returns," 1878.

manchineel, and "white cedar," in Nevis. From Montserrat there were exhibited at the Colonial and Indian Exhibition *Diospyros virginalis*, "ebony;" *Hippomane mancinella*, L., "manchineel;" *Hymenæa Courbaril*, L., "locust;" *Laurus Cassia*, "red cinnamon;" *Quassia amara*, "bitter ash" or "bitter-wood;" and *Sapota Sideroxylon*, "balata" or "bullet-wood." Besides these, *Calophyllum Calaba*, "galba;" *Hæmatoxylon*, "logwood;" "red" and "white cedar," are valuable; whilst "birch," "acacia," "dogwood" (*Piscidia Erythrina?*), "redwood," "rosemary," "Spanish oak," "snakewood" (*Brosimum Aubletii?*), "manjack," "gun stock," "iron-wood," "sweet-wood" (*Oreodaphne exalbata?*), "Main support," and "greenheart" are recorded.

From Dominica there were exhibited—

Adenanthera pavonina, L. "Red sandal-wood."
Anacardium occidentale, L. "Cashew-nut."
Andira inermis, Kunth. "Angelin."
Bucida capitata, Dow. "Satin-wood," "Yellow sanders."
Bumelia retusa, Sw. "Balata," "Bullet-tree."
Calophyllum Calaba, Jacq. "Galba."
Cedrela odorata, L. "Cedar."
Crescentia Cujete, L. "Calabash."
Inga ingoides, W. "Bois doux maron."
Mammea americana, L. "Mammy apple."
Nectandra sanguinea, Rottb. "Laurier Madame."
Oreodaphne cernua, Ns. "Laurier cypre."
Ormosia dasycarpa, Jacq. "Caconier."
Persea gratissima, Gärtn. "Avocado pear."
Pithecolobium micradenium, Benth. "Pipirie," "Ciceru."
Prunus occidentalis, Swartz. "Noyeay," "Amandier."
Psidium Guava, Radd. "Guava."
Simaruba amara, Aubl. "Simarupa."
Sloanea Massoni, Sw. "Châtaignier Grande Feuille."
Symplocos martinicensis, Jacq. "Kakarat," "Bois Graine Bleue."

Tamarindus indica, L., and *Terminalia Catappa*, L. ("almond"), being naturalised East Indian species. There are also recorded "mastic," "resinier" (*Coccoloba*), "black cinnamon" (*Pimenta acris*, W. A. ?), "bois lizard" (*Brosimum Aubletii*, P. E. ?), "savonette" (*Sapindus Saponaria*, L.), "acajou," "bois rivière," "olivier," "gommier" (*Bursera gummifera*, L.), used for canoes, "white cedar" (*Bignonia leucoxylon*, L.), "couchou," "mangrove pomme rose" (*Jambosa vulgaris*, DC.), besides logwood and satin-wood, the chief exported timbers. The Government own almost all of the 140,000 acres of timber-land.

Windward Islands.

Barbadoes is wholly dependent, even for fuel, upon importation; and the area under timber has been rapidly diminishing in the other islands of this group. Among the native trees of St Vincent are *Calophyllum Calaba*, Jacq., "Galba," used for furniture; *Citharexylon*, "fiddlewood," "bois fidèle," used for posts, shingles, etc.; *Hippomane mancinella*, L., "manchineel;" *Hœmatoxylon campechianum*, L., "logwood," used chiefly as fuel; *Hymenœa Courbaril*, L., "locust," used for furniture and in cart-building; *Nectandra*, "greenheart," used for wheel-naves; *Sapota mastichodendron*, Jacq., "mastic," used for posts and water-wheels; *S. Sideroxylon*, Gr., "bullet," used for carts and machinery; *Tecoma pentaphylla*, Juss., "white cedar," used for piles and boat-building; "cypress," used for shingles, and "laurier," for planks.

From Grenada, where the Crown owns about 2000 acres of timber, the chief wood exported is logwood, mahogany, and cedar. Manchineel and "savonette" (*Sapindus Saponaria*) are among the furniture-woods of the island; "galba," "calabash" (*Crescentia*), and "seaside grape" (*Coccoloba uvifera*), among those used for ship-building; logwood and mangrove, the chief fuel. For building, white cedar, logwood, bullywood, locust, gum arabic acacia, "laurier" (*Cordia*), "surette" (*Byrsonima*), "mangrove" (*Rhizophora*), "tapana" (*Rhopala*), "tendre accyon" (*Mimosa*), "sapodilla pennypiece," and "maromba" are employed; and the bark of the cashew (*Anacardium occidentale*), the hog plum (*Spondias*), guava, mangrove, and sea-side grape are used.

Nearly half the area (55 out of the 114 square miles) of Tobago is under wood. Among the valuable trees are "greenheart" (*Tecoma*), the "black greenheart" of Demerara; "cogwood" (*Tecoma pentaphylla*); "bullet tree" (*Sapota Sideroxylon*); "fiddlewood" (*Citharexylon melanocardium*); "white cypress" (*Cordia*); "black cypress" (*Laurus*); "wild tamarind" (*Mimosa arborea*); "soap-wood" (*Inga ingoides*); the "simaruba" (*Quassia excelsa*); the mastic; locust; fustic; angelin; manchineel, or "West India upas-tree;" the "pimenta," or "all-spice tree;" the "cedar" (*Cedrela odorata*), from which cigar-boxes are made; the "horse-flesh;" "purple-heart;" "crabwood;" "yellow prickle," and "yellow sanders."

In St Lucia, 118 square miles out of a total of 237 produce timber; and about two-thirds of this is in Government hands.

Among the characteristic species are *Cerasus Mahaleb*, the "wood of St Lucia;" *Citharexylon cinereum* and *C. surrectum*, "fiddle-wood;" *Sapota Mullerii*, "bullet-wood;" *Pimenta acris*, the "bayleaf tree," or "black cinnamon;" angelin, locust, galba, cedar, guava, cogwood, mastic, resinier, savonette, white cedar, rosewood, satinwood, orange, and tamarind.

Unfortunately many of the West Indian timbers at the Colonial and Indian Exhibition were very imperfectly labelled.

The Bahamas.

Out of a total area of 5390 square miles, the only wooded land in the Bahamas which can be called forest is the pine barren of the northern islands, covering about 1000 square miles, and some coppices of mahogany on Andros Island. The principal supply of wood comes from this island and from Acklins and Mayaguana, and mostly from Crown lands. The small amount exported includes Braziletto (*Cæsalpinia*), lignum-vitæ (*Guaiacum officinale*, L.), logwood, "satin" or "yellow wood" (*Chloroxylon Swietenia*, DC.), "Madeira mahogany" (*Swietenia Mahagoni*, L.), "horse-flesh mahogany," exported to England as "sabica" (*Swietenia*, sp.), "green ebony" (*Brya Ebenus*, DC.), and "cedar" (*Cedrela odorata*, L.). The native pine is *Pinus bahamensis*, Gr. "Mastic" (*Pistacia Lentiscus*) is useful in building; and among other species recorded are "button-wood" (*Conocarpus erectus*, L.), "iron-wood" (*Sloanea jamaicensis*, Hook.), "boxwood" (*Vitex umbrosa*, Sw.), "crabwood" (*Carapa guianensis*, Aubl.), "dogwood" (*Piscidia*), "poison-wood" (*Erythrina*), "naked wood," a kind of lance-wood, "red stopper," and "torchwood," besides mangrove (*Rhizophora*) and "prince-wood" (*Hamelia ventricosa*, Sw.), which are used in dyeing.

Bermuda.

With an area of about 19 square miles, Bermuda possesses between three and four thousand acres of timber, mostly belonging to the Imperial Government, from which there is a small export. The species, which are nearly all exotic, are—

Aleurites triloba, Forst. "Otaheite walnut."
Calophyllum Calaba, Jacq. "Galba."
Citharexylon quadrangulare, Jacq. "Fiddlewood."
Crescentia Cujete, L. "Calabash."
Erythrina indica, Lam. "Locust."
E. speciosa, Andr. "Sword plant."
Hura crepitans, L. "Sand-box tree."

Juniperus bermudiana, L. "Bermuda cedar."
Mammea americana, L. "Mammee apple."
Melia Azedarach, L. "Pride of India."
Olea europæa, L. "Olive."
Persea gratissima, Gärtn. "Avocado pear."
Salix babylonica, Tourn. "Willow."
Tamarindus indica, L. "Tamarind."
Tecoma pentaphylla, Juss. "White cedar."

United States.

The whole region east of the Mississippi, except the prairies north of the Ohio and the "barrens" of Kentucky and Tennessee, was, when first known to Europeans, a timbered country; but from Mexico northward to the Arctic Ocean is a broad treeless belt. East of this belt broad-leaved, deciduous hardwoods predominate both in species and in individuals; west of it the forests are almost wholly coniferous.[1] The area of woodland in the United States in 1870 was estimated at 380 million acres; but the increased demand for timber, its waste as fuel and in clearing, the absence until recently of any protective measures against reckless destruction or forest fires, has considerably denuded the Eastern States. Nevertheless the value of the forest products of the country in 1880 was estimated at 700 million dollars, but little short of the value of its wheat and cotton together. In "The North American Sylva," by F. A. Michaux (Philadelphia, 1865), to which an appendix of more recent discoveries was added by Professor Nuttall, the objectionable practice has been adopted of coining English names which have no scientific value, and neither have been, nor are likely to be, in common use. In the following list, which is mainly indebted to this work, only those English names have been inserted which are likely to be actually "understanded of the people."

Quercus alba, L. "White oak."
Q. Robur, L. "Common European oak."
Q. pedunculata. "European white oak.
Q. olivæformis, Michx. "Mossy-cup oak."
Q. macrocarpa, Michx. "Burr oak."
Q. obtusiloba, Michx. "Post oak."
Q. lyrata, Walt. "Over-cup oak."
Q. prinus discolor, Michx. "Swamp white oak."
Q. p. palustris. "Chestnut white oak."
Q. p. monticola, Michx. "Rock chestnut oak."
Q. p. acuminata, Michx. "Yellow oak."
Q. p. Chincapin, Michx. fil. "Small chestnut oak."
Q. virens, Ait. "American live oak."
Q. Suber, L. "Cork oak."
Q. Phellos, L. "Willow," or "willow-leaved oak."

[1] Précis, by Dr Lyons, M.P., of United States Reports, 1884.

Q. imbricaria, Michx. "Laurel oak."
Q. cinerea, Michx. "Upland willow oak."
Q. pumila, Watt. "Running oak."
Q. heterophylla, Michx. "Bertram oak."
Q. aquatica, Catesb. "Water oak."
Q. ferruginea, Michx. "Black Jack oak."
Q. Banisteri. "Bear oak."
Q. Catesbœi, Michx. "Barrens scrub oak."
Q. falcata, Michx. "Spanish oak."
Q. tinctoria, Bartr. "Black oak."
Q. coccinea, Wang. "Scarlet oak."
Q. borealis. "Grey oak."
Q. palustris, Du Roi. "Pin oak."
Q. rubra, L. "Red oak."
Q. Garryana, Dougl. "Western oak."
Q. aquifolia. "Holly-leaved oak."
Q. undulata, Torr. "Rocky Mountain oak."
Q. Douglasii. "Douglas oak."
Q. densiflora.
Q. Leana.
Castanea vesca, L. "American chestnut."
C. pumila, Michx. "Chincapin."
C. alnifolia. "Dwarf chestnut."
Fagus sylvatica, L. "White beech."
F. ferruginea, Aiton. "Red beech."
Carpinus americana, Michx. "American hornbeam."
C. ostrya (= *Ostrya virginica*, Willd. ?). "Ironwood."
Betula papyracea, Aiton. "Canoe birch."
B. alba, Spach. "European birch."
B. populifolia, Spach. "White birch."
B. lenta, L. (= *B. carpinifolia*, Ehrh.). "Sweet," "Black," or "Cherry birch."
B. lutea, Michx. fil. "Yellow" or "Grey birch."
B. nigra, L. (= *B. rubra*, Michx.). "River" or "Red birch."
B. occidentalis, Hook. "Black birch."
Alnus serrulata, Ait. "Common alder."
A. glauca, Michx. "Black alder."
A. rhombifolia, Nutt.
A. oregona.
A. tenuifolia.
A. maritima, Muhl.
Ulmus americana, L. "White elm."
U. alata, Michx. "Wahoo."
U. fulva, Michx. "Red elm."
U. campestris, With. "European elm" (native ?).
U. suberosa, Mœnch. (? *U. major*, Sm.). "Dutch elm" (native ?).
U. opaca.
U. racemosa, Thomas. "Rock," or "Swamp elm."
Planera ulmifolia.
Juglans regia, L. "European walnut."
J. nigra, L. "Black walnut."
J. cathartica. "Butternut."
Carya olivæformis, Nutt. "Peckan-nut."
C. amara, Nutt. "Bitter-nut."
C. aquatica, Nutt. "Water hickory."
C. tomentosa, Nutt. "Mockernut."
C. squamosa (= *C. alba*, Nutt. ?). "Shell-bark hickory."
C. laciniosa. "Thick-bark hickory."
C. porcina, Nutt. (= *C. glabra*, Torr. ?). "Pignut hickory."
C. myristicæformis, Michx. "Nutmeg hickory."
C. microcarpa, Nutt.
Myrica inodora, Bartr. "Candle-tree."
Platanus occidentalis, L. "Button-wood," "Sycamore," "Plane."
P. racemosa. "California button-wood."
Populus angulata, Ait. "Carolina poplar."
P. hudsonica. "American black poplar."
P. monilifera, Ait. "Virginia poplar."
P. argentea. "Cotton tree."

P. angustifolia, James.
P. balsamifera, L.
P. candicans, Ait. } "Balsam poplar."

P. tremuloïdes, Michx.
P. grandidentata, Michx. } "American Aspen."

P. canescens. "White poplar."

Salix nigra, Marsh. "Black willow."

S. ligustrina. "Champlain willow."

S. lucida, Muhl.; *S. speciosa*, *S. pentandra*, *S. lutea*, *S. argophylla*, *S. melanopsis.*

Ficus pedunculata, Willd. "Cherry fig."

F. brevifolia, Nutt.; *F. aurea*, Nutt.

Morus rubra, L. "Mulberry."

Celtis occidentalis, L. "American nettle-tree."

C. crassifolia, Lam. "Huck," or "Hack berry."

C. reticulata.
C. longifolia. } "Nettle-tree."

Maclura aurantiaca. "Osage orange," "Bow-wood."

Hopea tinctoria, L. "Sweet leaf."

Hippomane mancinella, L. "Manchineel."

Excœcaria lucida, Sw. "Poison-wood."

Stillingia sebifera, Michx. "Tallow tree."

Drypetes crocea, Poit.

Shepherdia argentea, Nutt. "Rabbit berry," "Buffalo berry." (*Elæagnaceæ.*)

Laurus sassafras, L. "Sassafras."

L. carolinensis, L. "Red bay."

L. Camphora. "Camphor tree."

Oreodaphne californica. "Californian laurel," "Spice-bush," "Balm of Heaven," "Cajeput-tree."

Coccoloba uvifera, Jacq., and *C. parvifolia.* "Sea-side grape."

Avicennia tomentosa, Jacq. (*Verbenaceæ.*)

Pisonia aculeata, L. (*Nyctagineæ.*)

Tecoma radicans, Juss. "Trumpet tree."

Catalpa bignonioides, Walt. "Catalpa."

Crescentia Cujete, L. "Calabash."

Cordia Sebestena, L.

C. floridana.

Olea americana, L. "Devil wood."

O. europœa, L. "Olive."

Chionanthus virginica, L. "Fringe-tree."

Fraxinus americana, L. "White ash."

F. tomentosa, Michx. "Red ash."

F. viridis, Michx. fil. "Green ash."

F. excelsior, L. "European ash."

F. sambucifolia, Lamk. "Black ash."

F. quadrangulata, Michx. "Blue ash."

F. platycarpa, Michx. "Carolina ash."

F. Oregana, Nutt. "Oregon black ash."

F. pauciflora, Nutt.

Ornus dipetala, Nutt. "Californian flowering ash."

Cliftonia ligustrina, Banks. "Buckwheat tree." (*Cyrillaceæ.*)

Cyrilla racemiflora, Walt.

Diospyros virginiana, L. "Persimmon," "Date plum."

Mimusops Sieberi, A. DC. "Sapotilla."

Bumelia lycioides, Gært.; *tenax*, Willd.; *angustifolia*, Nutt.; and *fœtidissima.*

Ardisia Pickeringia, Torr. & Gray.

Rhododendron maximum, L. "Dwarf rose bay."

Kalmia latifolia, L. "Mountain laurel."

Arbutus Menziesii, Pursh.

Andromeda arborea, L. "Sorel tree."

Pinckneya pubens, Michx. "Georgia bark." (*Rubiaceæ.*)

Cornus florida, L. "Dogwood."

C. Nuttallii, Audubon.

Nyssa sylvatica, Marsh. "Black gum." (*Cornaceæ.*)

N. aquatica, L. "Tupelo gum."

N. grandidentata, Michx. fil. "Large gum."

N. capitata, Walt. "Sour gum."

Papaya vulgaris? "Papaw."

Psidium buxifolium, Nutt. "Florida guava."

Calyptranthes Chytraculia, Sw.
Eugenia dichotoma, DC.; *procera*, Poir.; and *buxifolia*, Willd.
Terminalia Catappa, L. "Indian almond." (*Combretaceæ.*)
Conocarpus erecta, Jacq. "Button-tree."
Laguncularia racemosa, Gært. "White mangrove."
Rhizophora americana, Nutt. "Mangrove."
Liquidambar Styraciflua, L. "Sweet gum."
Pyrus americana, DC. "Mountain ash."
P. rivularis, Douglas.
P. coronaria, L. "Crab apple."
Mespilus arborea, Michx. "June berry."
Cratægus sanguinea, Torr. & Gray. "Red thorn."
C. arborescens, Ell.
Prunus americana, Marsh. "Wild plum."
Cerasus virginiana, Michx. "Wild cherry."
C. caroliniana, Michx. "Wild orange."
C. borealis, Michx. "Red cherry."
C. mollis, Doug., and *C. ilicifolia*, Nutt.
Robinia Pseud-acacia, L. "Locust."
R. viscosa, Vent. "Rose-flowered locust."
Virgilia lutea, Michx. "Yellow wood."
Gleditschia triacanthos, L. "Sweet locust."
G. monosperma, Walt. "Water locust."
Inga unguis-cati, Willd.
I. guadaloupensis, Desv.
Cercocarpus ledifolius, Nutt. "Feather-bush."
Piscidia Erythrina, L. "Jamaica dog-wood."
Pistacia vera. "Pistachio."
Rhus metopium, L. "Coral sumach."
Cotinus americanus, Nutt.
Styphonia integrifolia, Nutt.
Pavia lutea, Poir. "Large buckeye."
Æsculus californica, Nutt.
Æ. ohioensis, Michx. "Fetid" or "Ohio buckeye." (= *Æsculus glabra*, Willd.)
Sapindus marginatus, Willd. "Florida soap-berry."
Melicocca paniculata, Juss. "Genip tree," "Honey-berry."
Acer eriocarpum, Michx. "White" or "Soft maple."
A. rubrum, L. "Swamp" or "Red-flowering maple."
A. saccharinum, Wang. "Birdseye," "Hard" or "Sugar maple."
A. nigrum, Michx. "Black sugar tree."
A. platanoides, L. "Norway maple."
A. pseudo-platanus, L. "Sycamore."
A. striatum, Du Roi. "Moose-wood."
A. Negundo, L. "Box-elder," "Black ash."
A. montanum, Ait.
A. macrophyllum, Pursh. "Californian" or "Large-leaved maple."
A. circinatum, Pursh.
A. grandidentatum, Nutt. "Mountain sugar maple."
A. Drummondii, Hook. & Arn., and *A. tripartitum*, Nutt.
Negundo californicum, Torr. & Gray. "Californian box-elder."
Rhamnus carolinianus, Walt.
Colubrina americana, Nutt. "Snake-wood."
Ceanothus thyrsiflorus, Esch.
Schœffera buxifolia, Nutt. "Jamaica boxwood."
Ilex opaca, Ait. "American holly."
Ximenia americana, L. "Mountain plum."
Swietenia Mahagoni, L. "Mahogany."
Melia Azedarach, L. "Pride of India."
Amyris floridana, Nutt. "Florida torch-wood."
Bursera gummifera, Jacq. "West Indian birch."
Simaruba glauca, DC. "Bitter wood."

Zanthoxylum carolinianum, Lam. "Prickly ash."

Z. pterota, H. B. & K. "Bastard ironwood."

Z. floridanum, Nutt. "Florida satinwood."

Citrus vulgaris, Risso. "Wild orange."

Guaiacum sanctum, L. "Lignum-vitæ."

Tilia americana, L. "American Lime" or "Bass."

T. alba, Michx.; *T. pubescens*, Ait.; and *T. heterophylla*, Vent.

Gordonia lasianthus, L. "Loblolly bay."

G. pubescens, L'Herit.

Clusia flava, L. "Yellow-flowered balsam."

Asimina triloba, Duval. "Papaw."

Liriodendron tulipifera, L. "Tulip-tree," "Poplar," "White wood," "Saddle tree," "Virginian poplar."

Liriodendron tulipifera, var. *obtusiloba*, Michx. "Yellow wood," "Yellow poplar." The more valuable.

Magnolia grandiflora, L. "Laurel bay," "Laurier tulipier," "Large magnolia."

M. glauca, L. "Small magnolia."

M. acuminata, L. } "Cucumber
M. cordata, Michx. } tree."

M. tripetala, L. "Elkwood," "Umbrella tree."

M. auriculata, Lam. "Indian physic," "Cucumber tree." (=*M. Fraseri*, Walt.)

M. macrophylla, Michx. "Magnolier bannannier," "Umbrella tree."

Chamærops Palmetto, Michx. "Cabbage-tree," "Palmetto."

Taxus brevifolia, Nutt. "Western yew."

Torreya taxifolia, Arn.

Juniperus virginiana, L. "Red cedar," "Juniper."

J. andina. "Rocky Mountain juniper."

Thuja occidentalis, L. "White cedar," "Arbor-vitæ."

T. gigantea, Nuttall.

T. Lobbii.

Pinus rubra, Michx. fil. (=*P. resinosa*, Aiton?), "Red" or "Norway pine."

P. Pinea, L. "Stone pine."

P. rupestris. "Grey pine."

P. mitis, Michx. "Yellow pine."

P. sylvestris, L. "Wild pine."

P. inops, Ait. "New Jersey pine."

P. pungens, Michx. "Table Mountain pine."

P. australis, Michx.

P. serotina, Michx. "Pond pine."

P. rigida, Miller. "Pitch" or "Swamp pine."

P. Tæda, L. "Loblolly pine."

P. Strobus, L. "Weymouth" or "White pine," "Yellow pine" of commerce.

P. Sabiniana, Dougl. "Nut" or "Prickly-coned pine."

P. Lambertiana. "Great sugar" or "Gigantic pine."

P. insignis. "Monterey pine."

P. ponderosa, Dougl. "California yellow pine."

P. Coulteri, *P. Jeffreyi*, *P. aristata*, Eng.; *P. Balfouriana*, Jeffr.; *P. Ayacahuite*, *P. cembroides*.

Picea excelsa. "Norway spruce."

P. nigra, L. "Black" or "Double spruce."

P. alba, L. "White" or "Single spruce."

P. Menziesii, and *P. Engelmanni*, Parry.

Tsuga canadensis, Carrière. "Hemlock."

Pseudotsuga Douglasii, Carrière. "Douglas fir."

Abies balsamifera, Michx. fil. (=*A. Fraseri*, Pursh.). "Balm of Gilead" or "American silver fir."

A. nobilis, *A. bracteata*.

Taxodium distichum, Rich. "Deciduous" or "Swamp cypress."

Cupressus thyoides, L. "White cedar."
Larix americana, L. "Hackmatac," "American larch."
L. occidentalis, Nutt. "Western larch."
Sequoia gigantea, Endl. "Mammoth tree."
S. sempervirens. "Californian redwood."

Newfoundland.

Though forest fires and the absence of replanting was, in 1874, causing much reduction in the forests of Newfoundland, there were then in the island over 725 square miles, out of a total of 40,200, most of which is in Government hands, and more than half is situated in the Humber River Valley, which is rich in pine (*Pinus Strobus*, L.) and spruce (*Picea alba* and *P. nigra*). In the St George's Bay and Codroy Valley districts there is little pine. Spruce, "tamarack" or red larch (*Larix microcarpa*), "yellow birch" or "Wych hazel" (*Betula excelsa*), and "white birch" (*B. alba*) are abundant and of large size. The larch is said to be better than that of the mainland, and the yellow birch to be as durable as oak. Other important species are the "balsam fir" (*Abies balsamea*), the "aspen poplar" (*Populus tremuloïdes*, Michx.), the "balsam poplar" (*P. balsamifera*), and the "mountain ash" (*Fraxinus americana*).[1]

Dominion of Canada.

Prince Edward's Island.

In 1874 the forests of Prince Edward's Island occupied one-eighth of its area (2173 square miles), but were rapidly decreasing from fires, clearing, etc., much "cedar" (*Juniperus virginiana*) having been cut for railway purposes and other soft woods for building. Among the species are also white and black spruce (*Picea alba* and *P. nigra*), various varieties, "red," "white," and "black" of the "Hemlock" (*Tsuga canadensis*), "white birch" (*Betula papyracea*) and "yellow birch" (*B. lenta*), "rock maple" (*Acer saccharinum?*) and "white maple" (*A. dasycarpum?*), besides beech, hazel, oak, elm, ash, pine, and fir.[2]

Nova Scotia.

Nova Scotia was computed to contain nine million acres of timber land in 1875. The strongest and most durable timber is that of the larch or "Hackmatack" (*Larix americana*), whilst

[1] Mr Rogers's "Analysis of Returns," 1878.
[2] Rogers, *op. cit.*

next in utility rank the "white," "hard," "pitch" or "Norway pine" (*Pinus Strobus*, L.) and hemlock. Besides these there are:—"Balsam" or "silver fir" (*Picea balsamifera*); "white" and black" or "double spruce;" "mountain pine" (*Pinus Pinea*, L.); "black" or "yellow birch" (*Betula lutea*, Michx. ?), "white," "canoe," or "paper birch" (*B. papyracea*, Aiton), and "dwarf," "mountain," or "river birch" (*B. lenta*, L. ?); "sugar," "rock," or "birdseye maple" (*Acer saccharinum*, Wang.), "red," "flowering," "scarlet," or "swamp maple" (*A. rubrum*, L.), "mountain" or "dwarf maple" (*A. spicatum*, Lamk.), and "striped maple" or "moose-wood" (*A. striatum*, Lamk., or *A. pennsylvanicum*, L.?); beech (*Fagus sylvatica*, L.); elm (*Ulmus americana*, L.); hornbeam (*Ostrya virginica*, Willd.); "red oak" (*Quercus rubra*, L.); "white" and "black ash" (*Fraxinus americana*, L., and *F. sambucifolia*, Lamk.); "choke," "red" and "black" or "pigeon cherry" (*Prunus virginiana*, L. = *P. borealis?*, *P. pennsylvanica*, L., and *P. serotina*, Ehrh.), the latter extensively used in cabinet work; and various poplars, including *Populus tremuloïdes*, Michx., and *P. grandidentata*, Michx., used for paper pulp.

New Brunswick.

The timber-producing lands of New Brunswick in 1874 were estimated at six million acres, mainly covered with hard woods such as beech, of which there are two varieties, the "red" (*Fagus ferruginea*, Aiton) and the "white" (*F. sylvatica*, L.), the former the more valuable; black, yellow, white, and paper birch; "rock maple" (*Acer saccharinum*, Wang.), etc.; "white," "red," and "Prince's pine" (*Pinus Strobus*, L., *P. resinosa*, Aiton, and *P. Banksiana*, Lambert); "white" and "red elm" (*Ulmus americana*, L., and *U. fulva*, Michx.); "butternut" (*Juglans cinerea*, L.); "white," "black," and "red ash" (*Fraxinus americana*, L., *F. sambucifolia*, Lamk., and *F. pubescens*, Lamk.); "yellow ash;" "aspen" and "balsam poplar" (*Populus tremuloïdes*, Michx., and *P. angustifolia*, James?); "basswood" (*Tilia americana*, L.); "ironbeam" (*Ostrya virginica*, Willd.?) and "hornbeam" (*Carpinus americana*, Michx.) occurring in considerable quantities; and oak, chiefly *Quercus rubra*, L., in small quantities. Black spruce furnishes most of the deals exported, though the white and balsam spruces are also used. "Hackmatac" or "Tamarac" (*Larix americana*, Michx.), "Cedar" (*Cupressus thyoides*, L.), and

hemlock (*Tsuga canadensis*, Carr.) are among the most valuable timber trees in the provinces, cedar sleepers and hemlock bark-extract being considerable articles of export.[1]

Quebec.

Of nearly seventy-four million acres of forest in the province of Quebec in 1874, fifty-five and a-half belonged to Government; but the clearing has long been excessive. The species are mostly the same as those of New Brunswick, the commonest species being "white pine" (*Pinus Strobus*, L.), "yellow pine" (*P. mitis*, Michx.), "red pine" (*P. resinosa*, Aiton), "white cedar" (*Thuja occidentalis*, L.), "hard maple" (*Acer saccharinum*, Wang.), white and black spruce, tamarac, and white elm. The white oak (*Quercus alba*, L.), the only species in the province, is comparatively scarce.[2]

Ontario.

The timber trade forms the chief industry of the province of Ontario, 87 per cent. of the amount felled being exported. White and red pine, black and white spruce, "white" and "red cedar" (*Thuja occidentalis*, L., and *Juniperus virginiana*, Lawson), elm (*Ulmus fulva*, Michx.), and birch are the only abundant woods; but the following were exhibited from the province in the Colonial and Indian Exhibition:—

"Tulip tree," or "White wood." (*Liriodendron tulipifera*, L.)
"Cucumber tree," or "Papaw." (*Asimina triloba*, Dunal.)
"Basswood," or "Linden." (*Tilia americana*, L.)
"Striped maple." (*Acer pennsylvanicum*, L.)
"Mountain maple." (*A. spicatum*, Lamk.)
"Sugar maple." (*A. saccharinum*, Wang.)
"Black maple." (*A. nigrum*, Michx.)
"Silver or white maple." (*A. dasycarpum*, Ehrh.)
"Red or soft maple." (*A. rubrum*, L.)
"Staghorn sumach." (*Rhus typhina*, L.)
"Wild plum." (*Prunus americana*, Marshall.)
"Bird cherry." (*P. pennsylvanica*, L.)
"Choke cherry." (*P. virginiana*, L.)
"Black cherry." (*P. serotina*, Ehrh.)
"American crab apple." (*Pyrus coronaria*, L.)
"American mountain ash." (*P. americana*, DC.)
"Cockspur thorn." (*Crataegus crus-galli*, L.)
"Scarlet-fruited thorn." (*C. coccinea*, L.)

[1] Rogers, *op. cit.*; "The Woods and Wooden Manufactures of the Province," by Ira Cornwall; in "St John and New Brunswick," by John R. Hamilton, St John, 1884; and "New Brunswick," by C. H. Lugrin, 1886.

[2] Rogers, *op. cit.*

"Black," or "Pear thorn." (*C. tomentosa*, L.)
"Downy-leaved thorn." (*C. subvillosa*, Schräder.)
"June berry." (*Amelanchier canadensis*, Torr. & Gray.)
"Flowering dogwood." (*Cornus florida*, L.) (*Cornus alternifolia*, L.)
"Black," or "Sour gum tree;" "Pepperidge." (*Nyssa sylvatica*, Marshall.)
"Sheep berry." (*Viburnum Lentago*, L.)
"Red," or "River ash." (*Fraxinus pubescens*, Lamk.)
"White river ash." (*F. americana*, L.)
"Black," or "Swamp ash." (*F. sambucifolia*, Lamk.)
"Sassafras." (*Sassafras officinale*, Nees.)
"Slippery elm." (*Ulmus fulva*, Michx.)
"White," or "American elm." (*U. americana*, L.)
"Rock elm." (*U. racemosa*, Thomas.)
"Sugar," or "Hack berry." (*Celtis occidentalis*, L.)
"Red mulberry." (*Morus rubra*, L.)
"Plane," or "Sycamore." (*Platanus occidentalis*, L.)
"Waney black walnut." (*Juglans nigra*, L.)
"Butternut." (*J. cinerea*, L.)
"Shell-bark hickory." (*Carya alba*, Nuttall.)
"White-heart hickory." (*C. tomentosa*, Nuttall.)
"Pig-nut," or "Brown hickory." (*Carya porcina*, Nuttall.)
"Bitter-nut," or "Swamp hickory." (*C. amara*, Nuttall.)
"White oak." (*Quercus alba*, L.)
"Burr," or "Over-cup oak." (*Q. macrocarpa*, Michx.)
"Swamp white oak." (*Q. bicolor*, Willd.)
"Chestnut oak." (*Q. prinus*, L.)
"Red oak." (*Q. rubra*, L.)
"Scarlet oak." (*Q. coccinea*, Wange.)
"Yellow-barked," or "Black oak." (*Q. tinctoria*, Bartram.)
"Swamp," or "Pin oak." (*Q. palustris*, Du Roi.)
"Chestnut." (*Castanea vulgaris*, var. *americana*, DC.)
"Beech." (*Fagus ferruginea*, Aiton.)
"Iron-wood." (*Ostrya virginica*, Willd.)
"Blue beech." (*Carpinus caroliniana*, Walter.)
"Yellow," or "Grey birch." (*Betula lutea*, Michx.)
"White," "Paper," or "Canoe birch." (*B. papyracea*, Aiton.)
"Cherry," "Sweet," or "Black birch." (*B. lenta*, L.)
"Hoary Alder." (*Alnus incana*, Willd.)
"Black willow." (*Salix nigra*, Marsh.) (*Salix discolor*, Muhl.)
"Aspen." { *Populus tremuloïdes*, Michx. / *P. grandidentata*, Michx.
"Cotton-wood." (*P. monilifera*, Aiton.)
"White cedar," "Arbor-vitæ." (*Thuja occidentalis*, L.)
"White pine." (*Pinus Strobus*, L.)
"Red," or "Norway pine." (*P. resinosa*, Aiton.)
"Pitch pine." (*P. rigida*, Miller.)
"Scrub," or "Jack pine." (*P. Banksiana*, Lambert.)
"White spruce." (*Picea alba*, L.)
"Black spruce." (*P. nigra*, L.)
"Hemlock." (*Tsuga canadensis*, Carrière.)
"Balsam." (*Abies balsamea*, Miller); and
"Tamarac," or "Black larch." (*Larix americana*, L.)

British Columbia.

Two-thirds of British Columbia, or about 110 million acres, almost entirely under Government control, was, in 1874, under timber. The following species are characteristic :—

Rhamnus Purshiana, DC.
Acer circinatum, Pursh. "Vine maple."
A. macrophyllum, Pursh.
Negundo accroïdes, Mœnch. "Ash-leaved maple."
Prunus emarginata, Walp. "Western wild cherry."
Pyrus rivularis, Douglas. "Western crab apple."
Cratægus Douglasii, Lindley. "Western thorn."
Cornus Nuttallii, Audubon. "Flowering dogwood."
Arbutus Menziesii, Pursh. "Madrona."
Quercus Garryana, Douglas. "Western white oak."
Alnus rubra, Bongard. "Red," or "Western alder."
A. rhombifolia, Nuttall.
Salix lasiandra, Bentham, and *S. flavescens*, var. *Scouleriana*.
Populus balsamifera, L. / *P. angustifolia*, James. — "Balsam poplar," or "Balm of Gilead."
P. trichocarpa, Torrey & Gray. "Cotton wood."
Thuja gigantea, Nuttall. "Red cedar."
Chamæcyparis nutkaensis, Spach. "Yellow cypress."
Juniperus occidentalis, Hooker. "Juniper."
Taxus brevifolia, Nuttall. "Yew."
Pinus monticola, Douglas. "Western white pine."
P. ponderosa, Douglas. "Yellow," or "red pine."
P. contorta, Douglas. "Western scrub pine."
P. Murrayana, Balfour. "Black pine."
P. albicaulis, Engel. "White-barked pine."
Picea sitchensis, Carrière. "Black," "Sitka," or "Menzies spruce."
P. Engelmanni, Parry. "Western white spruce."
Tsuga Mertensiana, Carrière. "Western hemlock."
Pseudotsuga Douglasii, Carrière. "Douglas Fir," or "Oregon pine."
Abies grandis, Lindley. "White fir."
A. sub-alpina, Engelm. "Western balsam."
Larix Lyallii, Parlatore. / *L. occidentalis*, Nuttall. — "Tamarac."[1]

Sandwich Islands.

The flora of the Hawaiian group, though they are on the northern tropic, is most closely allied to that of New Guinea and Polynesia; but three-fourths of the species are endemic. Among the forest-trees common to these other regions there are enumerated by Dr William Hillebrand[2] :—*Aleurites moluccana*, *Jambosa*

[1] The lists of timbers of Ontario and British Columbia are mainly based on those in the official catalogue of the Canadian Court of the Colonial and Indian Exhibition.

[2] "Encyclopædia Britannica," vol. xi., p. 530.

maluccensis, *Alphidoxia excelsa*, *Dodonæa viscosa*, *Thespesia populnea*, *Cordia subcordata*, *Artocarpus incisa*, *Paritium tiliaceum*, *Broussonetia papyrifera*, and *Cordyline terminalis*; whilst among the endemic species he mentions—*Metrosideros polymorpha*, *Acacia Koa*, and species of *Sophora*, *Elæocarpus Sapota*, *Myrsine*, *Olea*, and *Pisonia*. *Santalum Freycinetianum* is the true, and *Myoporum tenuifolium* the spurious, sandal-wood of the Sandwich Isles.

Pacific Islands.

Situated mainly between the Tropics, the islands of the Pacific have generally a humid atmosphere, in which ferns often form nearly 25 per cent. of the flora; epiphytic and other aroids and climbing peppers abound; and palms, such as the cocoa-nut and sago, are the chief trees. In addition to breadfruit and banana, mangoes and custard apples are commonly cultivated, and the "candle-nut tree" (*Aleurites Moluccana*, Willd.) is widely distributed.

Fiji Islands.

In this archipelago of eighty inhabited islands, exceeding in total area the principality of Wales, and now forming part of the British Empire, we have "dense forests containing numerous varieties of large and valuable trees," especially on the south-eastern or windward sides of the islands. Among the timbers, the best known and most useful are :—

Acacia Richii, A. Gray. "Qumu." Used for furniture. (*Leguminosæ.*)

Afzelia bijuga, A. Gray. "Vesi." A durable, hard, heavy, dark brown wood.

Alphitonia franguloides, A. Gray. "Doi." (*Rhamneæ.*)

Alstonia vitiensis, Seem. "Drega Quru quru." (*Apocynaceæ.*)

Bischoffia javanica, Blume. "Koka damu." Hard, durable, dark red. (*Euphorbiaceæ.*)

Calophyllum Burmanni. "Damanu." Tough, strong, light brown, and veined. (*Guttiferæ.*)

C. inophyllum, L. "Dilo." Light brown, beautifully veined, suitable for cabinet work, its seeds yielding "Tacamahaca," or "Dilo" oil, a specific for rheumatism.

Cinnamomum pedatinervium, Meisn. "Macou." Soft. (*Lauraceæ.*)

Cordia sub-cordata, Lam. "Nawa nawa." (*Cordiaceæ.*)

Couthovia corynocarpa, A. Gray. "Olo." Good and hard. (*Loganiaceæ.*)

Dacrydium elatum, Wall. "Dakua salu salu." Durable, light brown wood, used in boat-building.

Dammara vitiensis, Seem. "Dakua." Allied to, but larger than the New Zealand Kauri Pine, and yielding the gum-resin, "Makadré." (*Coniferæ.*)

Dracontomelon sylvestre, Blume. "Tarawau Ki-Coge." (*Anacardiaceæ.*)

Eugenia effusa, A. Gray, *E. speciosa*, etc. "Yasi yasi." Good durable timbers for house-building. (*Myrtaceæ.*)

E. Jambosa. "Sea." Hard.

Fagræa Berteriana, A. Gray. "Bua." Soft. (*Loganiaceæ.*)

Ficus speciosa. "Losi." Tough and good. (*Moreæ.*)

Guettarda speciosa, L. "Bua-bua." A hard, heavy, light yellow wood, resembling box. (*Rubiaceæ.*)

Hibiscus tiliaceus, L. "Vau." A tough, light wood, similarly employed. (*Malvaceæ.*)

Homalium vitiense, Benth. (*Samydaceæ.*)

Lumnitzera coccinea, W. and A. "Sigali." Hard, durable in water, and insect-proof. (*Combretaceæ.*)

Marlea vitiensis, Benth. "Musk-wood." (*Cornaceæ.*)

Morinda citrifolia, L. "Kura." Used in turnery. (*Rubiaceæ.*)

Myristica macrophylla, A. Gray. "Mali." (*Myristicaceæ.*)

Nephelium pinnatum, Camb. "Dawa." Used for furniture. (*Sapindaceæ.*

Parinarium laurinum, A. Gray. "Makiti." (*Rosaceæ.*)

Pittosporum Richii, A. Gray. "Tadiri." (*Pittosporeæ.*)

Podocarpus cupressina, R. Br. "Cavana Tabua." Dense and heavy. (*Coniferæ.*)

P. vitiensis, Seem. "Kau solo."

Pongamia glabra, Vent. "Visi vesi." (*Leguminosæ.*)

Premna taitensis, Schauer. "Creona." Very durable. (*Verbenaceæ.*)

Pterocarpus indicus, Willd. "Cibi cibi." (*Leguminosæ.*)

Santalum Yasi, Seeman. "Sandal-wood." (*Santalaceæ.*) Once plentiful, is now scarce.

Serianthes vitiensis, A. Gray. "Vai vai." Tough and light, making excellent boat-planks. (*Leguminosæ.*)

Terminalia Catappa, L. "Tavola." Good and durable. (*Combretaceæ.*)

Trichospermum Richii, Seem. "Maku." Soft. (*Tiliaceæ.*)

Trophis anthropophagorum, Seem. "Malawaci." (*Urticaceæ.*)

Xylocarpus granatum, Kœn. "Dabi." (*Meliaceæ.*)

"Caukalou," or "Yaka," and "Caukuru," are handsome species of *Casuarina*, resembling oak. "Moliwai" is a species of *Citrus;* "Vutukaloa" of *Barringtonia;* "Vola," used for furniture, of *Metrosideros;* and "Bau vudi" and "Bau loa" are hard euphorbiaceous woods. Teak, logwood, mahogany, sissoo, camphor, gutta-percha, and various spice-bearing trees have been introduced.[1]

Friendly Isles, etc.

In addition to four species of Palm, one of which is the Fijian *Kentia*, the adjacent group of the Friendly Islands produces "Tamanu" (*Calophyllum Burmanni*), "Milo" (*Thespesia populnea*), "Futu" (*Barringtonia speciosa*), "Ironwood" (*Casuarina*, sp.), and other undetermined species. The New Hebrides bear the

[1] This list is taken partly from the "Handbook to Fiji: Colonial and Indian Exhibition," partly from the labels of the specimens exhibited.

cocoa-nut palm, *Aleurites triloba*, *Casuarina*, *Ficus*, various *Myrtaceæ*, and a kind of Kauri pine (*Dammara?*).

New Caledonia, etc.

With a sub-tropical flora of a generally Polynesian type, New Caledonia is linked to Australia, as are the New Hebrides, by *Myrtaceæ*, such as "Niaulis," *Melaleuca viridiflora*, valuable alike for its timber, bark, and cajeput oil; and by Araucarias, such as *A. Cookii* and *A. Rulei;* and to New Zealand by a Kauri pine (*Dammara?*). "Tamanou" (*Calophyllum montanum*), *Cordia Sebestena*, "Ironwood" (*Casuarina?*), and Acacias also abound. The Norfolk Island pine (*Araucaria excelsa*) is endemic to that island.

AUSTRALASIA.

Though there are vast tracts in the interior of Australia covered with "scrub," the area of timber-producing forest is comparatively small, and belongs mainly to the eastern colonies. The foliage is usually evergreen, being often phyllodinous and glaucous. *Eucalyptus* and *Acacia* compose four-fifths of the forests, other prevalent genera being *Callitris*, *Casuarina*, *Banksia*, *Melaleuca*, *Xanthorrhœa*, and *Exocarpus*. From their rapid growth, and the durability, strength, and toughness of their wood, the gum-trees (*Eucalypti*) are especially valuable. Conservation has now begun; but mine-props, and even firewood, are locally scarce.[1]

Queensland.

Wooden buildings, the almost exclusive use of wood as fuel, railway and telegraph needs, and wholesale clearing for agriculture, have much thinned the timber of Queensland; but the red cedar (*Cedrela Toona*, Roxb.), and Moreton Bay, Kauri, and cypress pines (*Araucaria Cunninghamii*, Aiton, *Agathis robusta* and *Callitris robusta*, R. Brown) are considerable articles of export. The following list is taken from the very full and carefully compiled catalogue, by F. M. Bailey, F.L.S., colonial botanist, in the "Catalogue of the Queensland Exhibits: Colonial and Indian Exhibition," which describes the trees, their wood, and uses, giving colonial and native names, and distribution outside Queensland.

Wormia alata, R. Brown. (*Dilleniaceæ.*) Dark, close-grained. Cabinet work. Also in New Guinea.

Eupomatia laurina, R. Brown. (*Anonaceæ.*) Also in New South Wales.

[1] Dr Cleghorn, "Encyclopædia Britannica," ix., 407.

Capparis nobilis, F. von Mueller. (*Capparidæ.*) "Native Pomegranate." Light, close-grained. New South Wales.

C. Mitchelli, Lindl. "Pomegranate," "Karn-doo-thal." Similar wood. Also in New South Wales and South Australia.

Cochlospermum Gregorii, F. v. M. (*Bixineæ.*)

Pittosporum phillyræoides, DC. (*Pittosporeæ.*) Very hard, light wood. Common to all the colonies.

Bursaria incana, Lindl. "Native Olive." Light wood, suitable for engraving.

Citriobatus multiflorus, A. Cunn. Also in New South Wales and South Australia.

C. pauciflorus, A. Cunn. North Australia.

Calophyllum inophyllum, L. (*Guttiferæ.*) "Alexandrian Laurel," "Domba-tree." Reddish, durable wood. New Guinea, India, etc.

C. tomentosum, Wight. "Keena," or "Poon Spar Tree." Generally useful. India.

Hibiscus heterophyllus, Vent. (*Malvaceæ.*) Pale yellow, tough wood, suitable for musical instruments. Also in New South Wales.

H. tiliaceus, L. "Cotton-tree," "Talwalpin." Close-grained, dark green wood, taking a polish. Fibre known as "Bola" in Bengal, "Majagua" in Central America.

Lagunaria Patersoni, Don, var. *bracteata*.

Bombax malabaricum, DC. "Silk-cotton tree." Light, coarse-grained, soft. India, etc.

Sterculia quadrifolia, R. Br. (*Sterculiaceæ.*) Light-grey, close-grained, easily worked. Also in New South Wales and North Australia.

S. acerifolia, A. Cunn. "Flame-tree." New South Wales.

S. diversifolia, G. Don. New South Wales and Victoria.

Tarrietia argyrodendron, Benth. "Stave-wood," "Boiong." Resembles beech. New South Wales.

T. trifoliolata, F. v. M. "Stave-wood." New South Wales. Darker.

T. actinophylla, Bail. Resembles ash, but more flexible.

Heritiera littoralis, Dry. "Red mangrove," or "Looking-glass tree." Dark, firm, useful wood. New Guinea and India.

Commersonia echinata, Forst. Yields a fibre used for nets. New South Wales, New Guinea, and Pacific.

Elæocarpus Kirtonii, F. v. M. (*Tiliaceæ.*) "White beech" of Bunya Mountains. Resembles sycamore. New South Wales.

E. Bancroftii, F. v. M. & Bail.

E. obovatus, G. Don. "Woolal." New Guinea, North Australia, New South Wales.

E. grandis, F. v. M. "Brisbane quandong," "Calshum." These species yield similar timber.

Erythroxylon australe, F. v. M. (*Lineæ.*) Red, close-grained; prettily marked.

Bosistoa sapindiformis, F. v. M. (*Rutaceæ.*) "Towra." Yellow wood; liable to split. New South Wales.

Melicope neurococca, Benth. Hard, light-yellow wood. New South Wales.

Evodia micrococca, F. v. M. New South Wales.

E. accedens, Blume. "Bunnee-walwal." Resembles Linden. New South Wales.

Medicosma Cunninghami, Hook. fil. Close-grained, light-yellow wood. Cabinet work. New South Wales.

Zanthoxylum veneficum, Bailey. Yellow; easy to work.

Z. brachyacanthum, F. v. M. "Satin-wood." Glossy yellow; superior to *Chloroxylon Swietenia*, DC. New South Wales.

Geijera Muelleri, Benth. Heart-wood dark-clouded; sapwood light, but hard. Veneers.

G. salicifolia, Schott. Light-coloured. New South Wales.

Acronychia lævis, Forst. Hard; light-coloured. New South Wales.

Halfordia drupifera, F. v. M. Yellow, tough, durable.

H. scleroxyla, F. v. M. Grey, fine-grained, tough.

Atalantia glauca, Hook. fil. "Kumquat," "Lime of the Downs." Bright yellow, streaked with brown; close-grained. Fruit preserved.

Citrus australis, Planch. "Native orange." Light-yellow, close-grained, hard, durable. Cabinet work, and probably engraving. Fruit preserved.

C. australasica, F. v. M. "Finger lime." Fruit preserved.

Ailanthus imberbiflora, F. v. M. (*Simarubeæ.*) Yellow, porous, soft, light wood.

Cadellia monostylis, Benth. Prettily grained; yellow.

Garuga floribunda, Decaisne. (*Burseraceæ.*) Grey, tough, close-grained. North Australia and Timor.

Canarium australasicum, F. v. M. Grey; easily worked. North Australia.

Turræa pubescens, Hellen. (*Meliaceæ.*) Close-grained, hard, dark in centre. Sapwood bright yellow. New Guinea and India.

Melia composita, Willd. "White cedar." Light red; soft. New Guinea, India, etc.

Dysoxylon Muelleri, Benth. "Pencil cedar," "Kedgy-kedgy." Red; prettily marked. Cabinet work. New South Wales.

D. rufum, Benth. Light-yellow, hard. New South Wales.

D. rufum, var. *glabrescens*. Coarser grained.

D. Fraserianum, Benth. "Pencil cedar." Similar to

D. Muelleri. New South Wales.

D. oppositifolium, F. v. M. Prettily marked, fragrant, close-grained, easily worked. Sapwood yellow. Cabinet work.

Amoora nitidula, Benth. Light-coloured; tough. New South Wales.

Owenia acidula, F. v. M. "Sour plum," "Emu apple." Reddish; hard, but easily worked. Cabinet work and turnery. New South Wales and South Australia.

O. venosa, F. v. M. Similar; very strong and durable.

Carapa moluccensis, Lam. Resembling red cedar; prettily marked. Cabinet work. Tropical Africa and Asia.

Cedrela Toona, Roxb. "Red cedar," "Toon," "Mamin," "Mugurpul," "Woota." Beautifully grained, red, durable wood. The chief wood used by cabinet-makers in Queensland. New South Wales, India, etc.

Flindersia australis, R. Br. "Crow's ash." Yellow; very hard and durable. New South Wales.

F. Schottiana, F. v. M. Similar. Cabinet work. New South Wales.

F. Oxleyana, F. v. M. "Common yellow wood." Strong, fibrous; resists white ant. Cabinet work, shafts, etc. New South Wales.

F. maculosa, Lindl. "Spotted tree." Similar. Very hard.

F. Bourjotiana, F. v. M. Light-coloured, strong, durable.

F. Strzeleckiana, F. v. M. "Spotted tree," and its var. *latifolia*. Similar to *F. maculosa*.

F. Bennettiana, F. v. M. Light-coloured, hard, fine-grained. New South Wales.

Ximenia americana, L. (*Olacineæ*.) A substitute for sandalwood, or possibly box. Throughout the Tropics.

Villaresia Moorei, F. v. M. Light, close-grained, prettily marked. New South Wales.

Celastrus bilocularis, F. v. M. Light grey, close-grained.

C. Cunninghamii, F. v. M. Pinkish, prettily marked. Veneers. North Australia and New South Wales.

Denhamia pittosporoides, F. v. M. Resembling elder wood. New South Wales.

Elæodendron australe, Vent. Pinkish, very tough, but warps. North Australia and New South Wales.

E. melanocarpum, F. v. M. Light, tough. North Australia.

Siphonodon australe, Benth. "Ivory wood." White, close-grained. Cabinet work and probably engraving. New South Wales.

Ventilago viminalis, Hook. (*Rhamneæ*.) Dark brown, hard, heavy. New South Wales and South Australia.

Alphitonia excelsa, Reissek. "Red ash," "Mee-a-mee." Dark brown heart, pinkish sapwood; close-grained, tough, but warps. New Guinea, North Australia, and New South Wales.

Vitis hypoglauca, F. v. M. (*Ampelideæ*.) Grey, spongy. New South Wales and Victoria.

V. sterculifolia, F. v. M. Light brown, spongy. New South Wales.

Diploglottis Cunninghamii, Hook. fil. (*Sapindaceæ*.) "Native tamarind." Light, very tough. New South Wales.

Cupania anacardioides, A. Rich. "Tuckeroo." Light pink, tough. North Australia and New South Wales.

C. pseudorhus, A. Rich. Light-coloured, tough. Pick handles. New South Wales.

C. xylocarpa, A. Cunn. Light yellow, resembling lancewood. Tool handles. New South Wales.

C. nervosa. Heart-wood dark. New South Wales.

Ratonia pyriformis, Benth. Light, tough; suitable for axe handles. New South Wales.

R. tenax, Benth. Heart-wood dark. New South Wales.

Atalaya hemiglauca, F. v. M. "Cattle-bush." Yellowish, hard. New South Wales and South Australia.

Nephelium tomentosum, F. v. M. Yellow, close-grained. New South Wales.

Heterodendron oleæfolia, Desf. Dark brown heart, yellow sapwood. Substitute for box. In all the colonies.

Harpullia pendula, Planch. "Tulip wood." Beautifully mottled, tough. New South Wales.

Akania Hillii, Hook. fil. "Turnip-wood." Light, close-grained, prettily marked. New South Wales.

Blepharocarya involucrigera, F. v. M. Light red, close-grained, soft.

Dodonæa triquetra, Andr. "Hop bush," "Kinjenga kilamul." Close-grained. New South Wales and Victoria.

D. viscosa, L. "Hop bush." Brown, close-grained. Throughout Australia, New Zealand, and the Tropics.

Rhus rhodanthema, F. v. M. (*Anacardiaceæ.*) "Dark yellow wood," "Jango-jango." Bronze yellow, fine-grained heart-wood. Cabinet work. New South Wales.

Buchanania mangoides, F. v. M. Pinkish, tough.

Semecarpus anacardium, L. "Marking nut tree." Yellow with brown markings, tough. Ink from fruit.

Euroschinus falcatus, Hook. fil. "Maiden's blush timber." Pink, very soft, tough. New South Wales.

Spondias pleiogyna, F. v. M. "Burdekin plum." Dark brown, marked with red, hard, resembling American walnut. Suitable for turnery or cabinet work.

Jacksonia scoparia, R. Br. (*Leguminosæ.*) "Dogwood." Yellowish, heart brown.

Hovea acutifolia, A. Cunn. Yellow, close-grained. New South Wales.

H. longipes, Benth. Dark yellow, very hard. New South Wales.

Erythrina vespertilio, Benth. "Cork tree." Straw colour, soft, light. North Australia.

E. indica, Lam. "Coral tree." Straw-coloured, light, soft. New Guinea, India, etc.

Dalbergia densa, Benth. Light, close-grained. New Guinea.

Lonchocarpus Blackii, Benth. Dark brown, stringy. New South Wales.

Pongamia glabra, Vent. Yellow, tough, prettily marked. North Australia, New Guinea, India, etc.

Podopetalum Ormondi, F. v. M. Pinkish grey, strong.

Castanospermum australe, A. Cunn. "Bean tree," "Moreton Bay chestnut." Heart-wood dark; valuable for turning; sapwood yellow. New South Wales.

Barklya syringifolia, F. v. M. Blackish grey, close-grained, tough. Tool handles. New South Wales.

Cassia Brewsteri, F. v. M. Pale yellow, nicely marked. Var. *tomentosa*. Pinkish, tough.

Bauhinia Carronii, F. v. M. "Queensland ebony." Brown, hard, heavy. Cabinet work. New South Wales.

B. Hookeri, F. v. M. "Queensland ebony." Similar, nicely marked. North Australia.

Cynometra ramiflora, L. Brown, coarse-grained, hard, heavy. Yields purple dye. India.

Erythrophlœum Laboucherii, F. v. M. "Ah-pill." Red, durable; the hardest wood in Australia. Spear heads, etc. North Australia.

Acacia fasciculifera, F. v. M. Red, hard. Useful for building. New South Wales.

A. sentis, F. v. M. Nicely marked. All the colonies.

A. falcata, Willd. Heart-wood light brown, heavy, tough; sapwood yellow. New South Wales.

A. macradenia, Benth. Tough. New South Wales.

A. neriifolia, A. Cunn. Dark, prettily marked, tough. New South Wales and South Australia.

A. salicina, Lindl. Dark brown, tough. All the colonies.

A. linifolia, Willd. Light-coloured, red in centre, tough. New South Wales.

A. podalyriæfolia, A. Cunn. "Silver wattle." Pinkish, nicely marked. New South Wales.

A. homalophylla, A. Cunn. "Myall," "Gidia," "Wong-arrah." Dark, hard, heavy, prettily marked. New South Wales, Victoria, and South Australia.

A. pendula, A. Cunn. "Weeping myall." Dark, hard, fragrant. Turnery, cabinetmaking. New South Wales.

A. stenophylla, A. Cunn. "Dalby myall." Dark, hard, prettily marked. Cabinet work. New South Wales, Victoria, South Australia.

A. harpophylla, F. v. M. "Brigalow." Brown, elastic, fragrant. Cabinet work.

A. excelsa, Benth. "Ironwood wattle." Dark, hard.

A. flavescens, A. Cunn. Brown, hard, prettily marked.

A. longifolia, Willd. Heart-wood brown, streaked with black; sapwood yellow. Cabinet work. South-eastern colonies.

A. glaucescens, Willd. "Rosewood." Heart-wood resembling walnut or *Dalbergia latifolia;* fragrant. Turnery, cabinet work, and veneers. New South Wales. Var. "Ringy rosewood," with transverse wavy lines.

A. doratoxylon, A. Cunn. "Mulga." Dark-brown, verd hard, prettily marked. South-eastern colonies.

A. torulosa, Benth. Dark-brown, tough. North Australia.

A. Cunninghamii, Hook. "Black wattle," "Kowarkul." Dark, hard, heavy, prettily marked. New South Wales.

A. leptocarpa, A. Cunn. Similar. Turnery, etc.

A. polystachya, A. Cunn. Similar. North Australia.

A. aulacocarpa, A. Cunn. "Hickory wattle." Dark red, hard, heavy, tough. Cabinet work.

A. calyculata, A. Cunn. Dark-brown, hard, heavy, close-grained. Turnery and cabinet work.

A. crassicarpa, A. Cunn. Dark, hard, prettily marked. North Australia.

A. polybotrya, var. *foliolosa*, Benth. Pinkish, close-grained, hard, beautifully marked.

A. decurrens, Willd. "Green wattle." Heart pinkish; sapwood white, tough. South-eastern colonies.

A. Bidwilli, Benth. "Yadthor." Light-yellow, darker at heart; close-grained, light. North Australia.

Albizzia Toona, Bail. "Acacia cedar," "Mackay cedar." Heart-wood resembling red cedar.

A. basaltica, Benth. "Dead finish." Heart dark-red; sapwood bright yellow; hard. Cabinet work.

A. Thozetiana, F. v. M. Red, hard, heavy, durable.

A. canescens, Benth. Resembling walnut. Cabinet work.

A. procera, Benth. Similar. India, etc.

Pithecolobium pruinosum, Benth. Light-yellow, brown at heart. New South Wales.

P. Tozeri, F. v. M. Similar, but red at heart; light, easily worked, close-grained. New South Wales.

Archidendron Vaillantii, F. v. M. Red, close-grained, strong, durable.

Parinarium Nonda, F. v. M. (*Rosaceæ.*) Light-yellow, cross-grained, very strong. North Australia.

Argophyllum Lejourdanii, F. v. M. (*Saxifrageæ.*) Yellow, close-grained, hard.

Cuttsia viburnea, F. v. M. White, close-grained, tough.

Davidsonia pruriens, F. v. M. Dark, hard, close-grained, tough.

Weinmannia lachnocarpa, F. v. M. "Marara," "Scrub redwood." Light pink; close-grained. New South Wales.

Rhizophora mucronata, Lam. (*Rhizophoreæ.*) "Mangrove." Light, reddish at heart, close-grained, tough. Throughout the Tropics.

Bruguiera Rheedii, Blume. "Red mangrove," "Kowinka." Light-coloured, tough, nicely marked. Axe and pick handles, etc. North Australia and Tropical Asia.

Carallia integerrima, DC. Similar. North Australia and Tropical Asia.

Terminalia oblongata, F. v. M. (*Combretaceæ.*) Light-coloured, nicely marked. Cabinet work.

T. bursarina, F. v. M. Dark, hard, prettily marked. Cabinet work. North Australia.

T. melanocarpa, F. v. M. Light-yellow, hard, tough.

T. sericocarpa, F. v. M. Darker heart.

T. Muelleri, Benth. Yellow, heart pinkish, tough, light; suitable for axe handles.

T. platyphylla, F. v. M. "Durin." Dark, prettily marked, close-grained, tough, hard.

T. porphyrocarpa, F. v. M. Yellow, nicely marked, close-grained, hard, tough. Cabinet work or building.

Lumnitzera racemosa, Willd. Pinkish-grey, hard, close-grained. Mangrove swamps throughout the Tropics.

Macropteranthes Fitzalani, F. v. M. Heart dark-grey; sapwood yellow; very close-grained and hard. Useful in turnery and cabinet work.

Gyrocarpus Jacquini, Roxb. Very light and soft. Throughout the Tropics.

Leptospermum flavescens, Sm. (*Myrtaceæ.*) Light-coloured, tough. East Australia, Indian Archipelago, etc.

L. myrtifolium, Sieb. Dark-coloured, tough. East Australia.

L. abnorme, F. v. M. Similar, hard, heavy. North Australia and New South Wales.

Callistemon lanceolatus, DC. "Red bottle brush," or "Water-gum;"

"Marum." Red, hard, tough. Ship-building and wheelwright's work. East Australia.

C. salignus, DC. Light-coloured, close-grained, durable.

Melaleuca symphyocarpa, F. v. M. Dark, prettily marked, close-grained, hard.

M. angustifolia, Gaertn. Similar. Posts and piles.

M. acacioides, F. v. M. Dark, strong. North Australia.

M. linariifolia, Sm. Dark-red, very durable. Piles. New South Wales.

M. leucadendron, L. "Paper-barked tea-tree." "Atchoourgo." Pinkish, hard, close-grained. Piles. Var. *saligna*, drooping, light grey. Var. *Cunninghamii*, darker.

M. genistifolia, Sm. Grey, hard, tough. North Australia and New South Wales.

Angophora subvelutina, F. v. M. "Apple tree." Pinkish-grey, tough. Wheelwright's work. New South Wales.

A. intermedia, DC. "Apple tree." Similar. More grey. Similarly used. Also in Victoria.

A. Woodsiana, Bail. Similar. Pinkish, with red gum.

A. lanceolata, Cav. "Rusty gum," "Toolookar." Pinkish, hard, heavy. New South Wales.

Eucalyptus Planchoniana, F. v. M. Grey, hard, heavy. Housebuilding. New South Wales.

E. eugenioides, Sieb. "Stringy bark." Pinkish, hard, tough. Building, fencing. New South Wales and Victoria.

E. acmenioides, Schau. "Stringy bark." Grey, close-grained, hard, durable. Building. New South Wales.

E. pilularis, Sm. "Blackbutt," "Tcheergun," "Toi." Light-grey, strong, durable. Various uses. East Australia.

E. ochrophloia, F. v. M. "Paroo yellow jacket." Brownish, close-grained, heavy. New South Wales.

E. gracilis, F. v. M. Yellowish-grey, hard, heavy, tough, durable.

E. hæmastoma, Sm. "White," or "Scribbly gum;" "Kurra-gurra." Grey or red, not durable. East Australia and Tasmania.

E. microcorys, F. v. M. "Turpentine," "Peppermint," "Tee." Grey, tough, durable. House and ship-building, naves, spokes, etc. New South Wales.

E. populifolia, Hook. "Poplar box." Grey or light-brown, very tough. Dray-poles, building, etc. New South Wales.

E. hemiphloia, F. v. M. "Gum-topped box." Yellowish grey, very tough, elastic. South-east colonies.

E. siderophloia, Benth. "Ironbark," "Tanderoo." Grey, hard, heavy, very durable. Beams, sleepers. New South Wales. Var. *rostrata*, red; too heavy for cabinet work; the best.

E. melanophloia, F. v. M. "Silver-leaved ironbark." Heart red; sapwood greyish; hard. New South Wales.

E. crebra, F. v. M. "Narrow-leaved ironbark." White, but pinkish-grey at heart; very tough and durable. North Australia and New South Wales.

E. Staigeriana, F. v. M. "Lemon-scented ironbark." Red, hard, durable. Oil from leaves.

E. Raveretiana, F. v. M. "Thozet's box," or "Iron gum tree." Dark-drab, speckled with white; very hard and tough. Building.

E. microtheca, F. v. M. "Jinbul," "Kurleah," "Coolibar." Heart deep-red; sapwood grey; hard. Building.

E. robusta, Sm. "Swamp mahogany gum," "Kimbarra," "Gnorpin." Deep-red. Building. New South Wales.

E. pallidifolia, F. v. M. Heart red; sapwood yellow, prettily mottled; hard. North Australia.

E. botryoides, Sm. "Woolly-butt," "Blue gum." Red, hard, tough, durable. Beams, etc. East Australia.

E. dealbata, A. Cunn. "Stanthorpe messmate." Pink, durable underground, but splits. New South Wales.

E. Stuartiana, F. v. M. "Stanthorpe box." Grey, hard, tough, durable. East Australia (including Tasmania).

E. rostrata, Schlech. "Stanthorpe yellow jacket." Dark, close-grained, strong, durable if kept dry.

E. exserta, F. v. M. Pinkish, hard, tough, durable.

E. tereticornis, Sm. "Blue gum," "Mungara." Red, tough, durable. Building, etc. East Australia.

E. platyphylla, F. v. M. "Broad-leaved poplar gum." Deep-red with gum-veins, hard. North Australia and New Guinea.

E. saligna, Sm. "Grey gum." Grey, very tough and hard. New South Wales.

E. resinifera, Sm. "Jimmy Low," "Red gum," "Mahogany." Rich red, strong, durable. Piles, beams, fencing. New South Wales.

E. clavigera, A. Cunn. Dark-brown, hard, durable.

E. phœnicea, F. v. M. Dark-brown heart, grey sapwood, tough, heavy.

E. tessellaris, F. v. M. "Moreton bay ash." Dark-brown, tough, durable. North Australia.

E. setosa, Schau. Dark-brown, with gum-veins, hard, strong, durable. North Australia.

E. corymbosa, Sm. "Bloodwood," "Boona." Red, with large gum-veins, durable. Piles, etc. The commonest species in Queensland. New South Wales.

E. trachyphloia, F. v. M. "White bloodwood." Grey, hard, heavy, durable. Useful.

E. Baileyana, F. v. M. "Rough stringy bark." Light-grey, very tough. Tool handles. Fibre from bark.

E. maculata, Hook. fil. "Spotted gum," "Urara." Light-grey, very elastic. Carriage building. New South Wales.

Tristania suaveolens, Sm. "Swamp mahogany," "Boolerchu." Red, hard, resists Teredo. North Australia and New South Wales.

T. conferta, R. Br. "Brisbane box," "Tubbilpulla." Dark-grey, hard, tough. Joists, ship-knees, etc. New South Wales.

T. exiliflora, F. v. M. Dark, very tough and elastic. Tool handles.

T. laurina, R. Br. Similar. New South Wales and Victoria.

T. macrosperma, F. v. M. Straw-colour, very hard and tough. Thursday Island and New Guinea.

Syncarpia laurifolia, Ten. "Turpentine." Dark-brown; warps. New South Wales.

S. leptopetala, F. v. M. Light colour, hard, tough, close-grained. New South Wales.

S. Hillii, Bail. "Turpentine tree of Frazer's Island," "Peebeen." Dark-pink, tough. Building.

Lysicarpus ternifolius, F. v. M. "Tom Russell's mahogany." Light-brown, hard, heavy, elastic. Sleepers.

Backhousia myrtifolia, Hook. & Harv. Light-grey, very hard and tough. New South Wales.

B. Bancroftii, Bail. & Müll. "Johnstone River," or "Langdon's hard-wood." Light-grey, hard; something like teak.

B. citriodora, F. v. M. Light-pink, hard.

Rhodomyrtus psidioides, Benth. Light-coloured, close-grained, tough. New South Wales.

R. macrocarpa, Benth. "Native Loquat." Light-grey, hard, tough.

Myrtus Hillii, Benth. Light-grey, very hard.

M. racemulosa, Benth. Tough; warps.

Rhodamnia sessiliflora, Benth. Dark, tough.

Eugenia Smithii, Poir. "Lilly-pilly," "Coochin-coochin." Dark, tough; warps. East Australia.

E. Ventenatii, Benth. "Water gum." Grey, soft. Boat-building, etc. New South Wales.

E. leptantha, Wight. Dark, easily worked.

E. Jambolana, Lam. Flesh-colour. Building. North Australia, India, etc.

E. corniflora, F. v. M. Dark, close-grained, tough.

E. grandis, Wight. "White apple." Light-brown, hard, tough, close-grained. India.

E. suborbicularis, Benth. Dark-grey, with rings of cork. Canoes.

E. Wilsoni, F. v. M. Dark-brown, hard, tough, close-grained. Tool handles.

E. myrtifolia, Sims. "Scrub cherry." Light-grey, tough. Tool handles. Fruit preserved. New South Wales.

Barringtonia speciosa, Forst. Yellow, tough. Eastern Tropics.

Careya australis, F. v. M. "Go-onje," "Guntha-marrah," "Ootcho." Light-grey, with red centre; tough. North Australia.

Lagerstræmia Archeriana, Bail. (*Lythraceæ.*) Brown, firm.

Homalium viticnse, Benth. (*Samydaceæ.*) White, close-grained. Cabinet work. New Caledonia and Fiji.

Panax Murrayi, F. v. M. (*Araliaceæ.*) Soft, light. New South Wales.

P. elegans, F. v. M. "Mowbulan whitewood," "Greyanger." Soft, light, elastic. Cricket bats, musical instruments, match boarding (?). New South Wales.

Brassaia actinophylla, Endl. "Umbrella-tree." Dark, soft, close-grained.

Marlea viticnsis, Benth. (*Cornaceæ.*) "Musk wood." Black heart; yellow sapwood. Musk-like smell. Cabinet work.

Sambucus xanthocarpus, F. v. M. (*Caprifoliaceæ.*) "Native elderberry." Light, soft. East Australia.

Sarcocephalus cordatus, Miq. (*Rubiaceæ.*) "Leichardt-tree," "Canary wood," "Oolpanje," "Coobiaby." Dark-yellow, soft, musk-scented. Yields a dye. Tropical Africa and Asia, etc.

Randia Fitzalani, F. v. M. Straw-colour, hard, tough.

R. densiflora, Benth. Light, hard, tough. Hong Kong, New Guinea, North Australia.

Gardenia Macgillivræi, Benth. Light, close-grained.

Guettarda putaminosa, F. v. M. Light-yellow, equal to box.

Timonius Rumphii, DC. Resembling sycamore. North Australia, Timor, Sumatra, etc.

Hodgkinsonia ovatiflora, F. v. M. White, firm. New South Wales.

Plectronia latifolia, F. v. M. Pink, with darker streaks, hard. Cabinet work. All the colonies.

P. odorata, F. v. M. Yellow, nicely marked, tough. North Australia and New South Wales.

P. vaccinifolia, Hook. fil. Straw-colour, tough. New South Wales.

P. barbata, Hook. fil. (=*Canthium coprosmoides.*) Dark-yellow, streaked with brown, prettily marked. Turnery and cabinet work. New South Wales.

P. buxifolia, Benth. Light, close-grained. Turnery.

Ixora timorensis, Decaisne. Light-coloured, hard, tough. North Australia, Timor, etc.

Morinda citrifolia, L. Dark-yellow, easy to work. Yields a dye. Eastern Tropics.

M. jasminoides, A. Cunn. Yellow, prettily marked. East Australia.

Cœlospermum reticulatum, Benth. Grey. A dye from the bark. North Australia.

Cassinia lævis, R. Br. (*Compositæ.*) "Wild rosemary." Dark, beautifully marked. Veneers. South Australia and New South Wales.

Trochocarpa laurina, R. Br. (*Epacridaceæ.*) Pinkish, nicely marked, hard. New South Wales.

Leucopogon melaleucoides, A. Cunn. Dark, nicely marked, hard. New South Wales.

Monotoca scoparia, R. Br. Pale-yellow, nicely marked, easily worked. East Australia and Tasmania.

Myrsine variabilis, R. Br. (*Myrsineæ.*) Light-coloured, firm. East Australia.

Ægiceras majus, Gaertn. "River mangrove." Light-coloured. North Australia and Eastern Tropics.

Chrysophyllum pruniferum, F. v. M. (*Sapotaceæ.*) Light-yellow, hard, tough. New South Wales.

Lucuma sericea, Benth. & Hook. Light-yellow, resembling birch. Cabinet work. North Australia.

Achras Pohlmaniana, F. v. M. Bright-yellow, hard, close-grained. Best Queensland wood for engraving.

A. laurifolia, F. v. M. Brown heart, light-grey sap.

A. australis, R. Br. Dark, tough. Building. New South Wales.

A. obovata, F. v. M. Yellow, hard.

Hormogyne cotinifolia, A. DC. Dark-yellow, very hard. New South Wales.

Mimusops parvifolia, R. Br. Pinkish, close-grained, firm, easily worked. North Australia.

M. Browniana, Benth. Red, fine-grained.

Maba fasciculosa, F. v. M. (*Ebenaceæ.*) Light-colour, with black streaks, strong, elastic. New South Wales.

M. geminata, R. Br. Heart black, a substitute for ebony. North Australia.

M. humilis, R. Br. Similar.

Diospyros hebecarpa, A. Cunn. Yellow, with black spots, very close-grained, tough.

D. pentamera, F. v. M. Tough. New South Wales.

Symplocos Stawellii, F. v. M. (*Styraceæ.*) White, substitute for box. New South Wales.

S. Thwaitesii, F. v. M. Light-coloured, tough. New South Wales.

Linociera ramiflora, DC. (*Oleaceæ.*) Dark-grey, mottled, easily worked. New Guinea, etc.

Notelæa longifolia, Vent. Light-coloured, hard, tough, close-grained. East Australia.

N. microcarpa, R. Br. Heart dark, very hard. New South Wales.

Olea paniculata, R. Br. "Billan-billan." Whitish, darker towards centre, prettily marked, hard, fragrant. New South Wales.

Cerbera Odollam, Gaertn. Dark-yellow, close-grained. India, New Guinea, etc.

Alstonia scholaris, R. Br. Light-coloured, soft. Tropical Africa, India, New Guinea.

A. verticillosa, F. v. M. Similar. North Australia.

A. villosa, F. v. M. Similar. Java.

A. constricta, F. v. M. "Bitter," or "Fever-bark," "Quinine-tree." Pale-yellow; warps. New South Wales. Var. *mollis*. White, close-grained.

Wrightia saligna, F. v. M. "Milk-bush." Pale-yellow, resembling elder. Suitable for carving. North Australia.

Fagræa Muelleri, Benth. (*Loganiaceæ.*) Yellow, hard.

Strychnos psilosperma, F. v. M. Light-yellow, with white streaks and black or dark heart, very hard.

Cordia Myxa, L. (*Borragineæ.*) "Sebestan-tree." Light-coloured, cross-grained, strong. India, etc.

Ehretia acuminata, R. Br. "Brown cedar." Light-brown, grain coarse, resembling elm. East Australia.

Solanum verbascifolium, L. (*Solanaceæ.*) Yellow, light, close-grained. New South Wales, Tropical Asia, and America.

Duboisia myoporoides, R. Br. Light-yellow, light, firm. Engraving. Source of Duboisine. New South Wales.

Diplanthera tetraphylla, R. Br. (*Bignoniaceæ.*) Whitish, close-grained, firm.

Graptophyllum Earlii, F. v. M. (*Acanthaceæ.*) Flesh-colour, brown at centre, very hard, tough.

Myoporum acuminatum, R. Br. (*Myoporineæ.*) "Mee-mee." Light-coloured, firm. All the colonies.

Eremophila Sturtii, R. Br. "Scentless sandalwood." Grey, nicely marked, hard. South Australia and New South Wales.

E. Mitchelli, Benth. "Scented sandal-wood." Brown, hard, very fragrant. Carving. New South Wales.

E. bignoniæflora, F. v. M. Yellowish-brown, prettily marked, fragrant. Cabinet work. North and South-East Australia.

Premna obtusifolia, R. Br. (*Verbenaceæ.*) Brown. North Australia.

Gmelina macrophylla, Benth. Sapwood purple, heart grey. Planking. North Australia.

G. Leichhardtii, F. v. M. "Queensland beech," "Cullonen." Light-grey; resists white ant. Planking for verandahs, etc. New South Wales.

Vitex lignum-vitæ, A. Cunn. "Lignum-vitæ." Dark, hard, tough. Cabinet work. New South Wales.

V. acuminata, R. Br. Brown with darker streaks, close-grained. Cabinet work. North Australia.

Clerodendron tomentosum, R. Br. Yellow, light, close-grained, easy to work. New South Wales.

Avicennia officinalis, L. "White mangrove," "Tchoonchee." Tough, hard, durable. Throughout the Tropics.

Pisonia Brunoniana, End. (*Nyctagineæ.*) Light-coloured, soft, light. New Guinea to New Zealand.

Codonocarpus australis, A. Cunn. (*Phytolaccaceæ.*) "Bell fruit." Soft, spongy. New South Wales.

Piper novæ-hollandiæ, Miq. (*Piperaceæ.*) "Native pepper vine." Coarse-grained, pungent. New South Wales.

Myristica insipida, R. Br. (*Myristiceæ.*) "Native nutmeg." Pinkish-grey, tough, easily worked. North Australia.

Mollinedia loxocarya, Benth. (*Monimiaceæ.*) Yellowish, prettily marked, close-grained.

Kibara longipes, Benth. Similar, straw-colour, hard.

Daphnandra aromatica, Bail. "Sassafras." Light; resembling, and a substitute for, pine.

D. micrantha, Benth. Greyish. New South Wales.

D. repandula, F. v. M. Light-coloured, nicely figured, close-grained; resembling holly.

Cryptocarya Murrayi, F. v. M. (*Laurineæ.*) Dark, hard.

C. obovata, R. Br. Light-coloured, tough. New South Wales.

C. glaucescens, R. Br. Similar. North Australia and New South Wales.

C. triplinervis, R. Br. Grey, tough, close-grained. New South Wales.

C. cinnamomifolia, Benth. Light-coloured, fine-grained.

C. australis, Benth. "Queensland laurel." Similar. New South Wales.

Beilschmiedia obtusifolia, Benth. & Hook. "Sassafras tree." Pale, close-grained. New South Wales.

Endiandra glauca, R. Br. Light-coloured, hard.

E. Sieberi, Nees. "Till." Grey or light brown, close-grained. Tool handles. New South Wales.

E. virens, F. v. M. Similar. New South Wales.

Cinnamomum Tamala, Th. Nees. "Native cinnamon." Grey, close-grained, scented. India, etc.

Litsea dealbata, Nees, var. *rufa*, Benth. Yellowish, with brown streaks; tough. New South Wales.

L. ferruginea, Benth. Pale yellow, nicely marked, light.

L. reticulata, Benth. "Cudgerie." Grey, light, easily worked.

Hernandia bivalvis, Benth. "Grease nut," "Cudgerie." Dark grey, close-grained, light and soft.

Persoonia falcata, R. Br. (*Proteaceæ.*) "Nanchee," "Booral." Light-coloured, reddish heart, hard, close-grained. North Australia.

P. media, R. Br. "Geebong," "Koombarra." Light, close-grained, resembling beech. New South Wales.

Macadamia ternifolia, F. v. M. "Queensland nut." Red, prettily marked. Cabinet work. New South Wales.

Xylomelum pyriforme, Knight. "Wooden pear." Dark-red, close-grained, tough, durable. New South Wales.

X. salicinum, A. Cunn. "Wooden pear." Similar.

Helicia ferruginea, F. v. M. Pinkish, nicely marked. Coopers' and cabinet work.

Orites excelsa, R. Br. "Silky oak." Grey, close-grained, hard, durable. New South Wales.

Kermadecia pinnatifida, Bail. Pinkish, prettily marked, close-grained. Coopers' and cabinet work.

Grevillea polystachya, R. Br. Red, hard, durable. Cabinet work. North Australia.

G. robusta, A. Cunn. "Silky oak," "Tuggan-tuggan." Light-pink, prettily marked. Cabinet work. New South Wales.

G. striata, R. Br. "Beefwood." Dark-brown, prettily marked, strong. New South Wales and South Australia.

G. gibbosa, R. Br. Similar, but greasy.

Hakea pedunculata, F. v. M. Dark-brown, hard.

Carnarvonia araliæfolia, F. v. M. Red, fine-grained.

Darlingia spectatissima, F. v. M. Light-brown, nicely marked, light, firm. Coopers' and cabinet work.

Cardwellia sublimis, F. v. M. "Gold spangle-wood." Light, prettily marked. Cabinet work.

Stenocarpus sinuatus, Endl. "Tulip-flower." Light-coloured. Substitute for beech. New South Wales.

S. salignus, R. Br. "Silky oak." Red, nicely marked, hard, close-grained. Cabinet work. New South Wales.

Banksia integrifolia, L. fil. "Honeysuckle," "Pomera." Pinkish, nicely marked, close-grained. Lasts, boat-building, cabinet work. East Australia.

B. dentata, L. fil. Dark-red, prettily marked, hard, close-grained. New Guinea.

B. æmula, R. Br. Similar, but warps. East Australia.

Wikstræmia indica, C. A. Meyer. (*Thymelæaceæ.*) Yellowish, soft. New South Wales and Tropical Asia.

Santalum lanceolatum, R. Br. (*Santalaceæ.*) "Tharra-gibberah." Bright-yellow, close-grained, firm. Cabinet work. All the colonies.

Exocarpus latifolia, R. Br. "Scrub sandal-wood," "Broad-leaved cherry." Dark, coarse-grained, hard, fragrant. New South Wales and Tropical Asia.

E. cupressiformis, Labill. "Cypress cherry," "Tchimmi-dillen." Pinkish-grey, soft, light, close-grained. All the colonies.

Ricinocarpus pinifolius, Desf. (*Euphorbiaceæ.*) Light-coloured, soft. East Australia and Tasmania.

Bridelia exaltata, F. v. M. Resembling walnut. Cabinet work. New South Wales.

B. fagina, F. v. M. Greyish-brown, mottled, dark heart.

Cleistanthus Cunninghamii, Muell. Arg. Light-coloured, hard, close-grained. New South Wales.

Phyllanthus Ferdinandi, Muell. Arg. "Towwar." Grey, close-grained; warps. North Australia and New South Wales.

Breynia oblongifolia, Muell. Arg. Straw-coloured, close-grained, firm. New South Wales.

Petalostigma quadriloculare, F. v. M. "Emu apple," "Crab tree," "Bitter bark," "Muntenpin." Dark-brown, hard, resembling *Cytisus Laburnum*. North Australia and New South Wales.

Hemicyclia australasica, Muell. Arg. Yellow, tough. New South Wales.

Dissiliaria baloghioides, F. v. M. "Currungul." Hard, brown, darker in centre, resembling apple.

Aleurites moluccana, Willd. "Candle-nut." Soft, light. Eastern Tropics.

Croton insularis, Bail. "Queensland cascarilla bark." Yellow, hard, close-grained, very tough.

C. phebalioides, F. v. M. Similar. New South Wales.

C. Verreauxii, Bail. Similar. North Australia and New South Wales.

Baloghia lucida, Endl. "Scrub bloodwood." Light-yellow, prettily marked, hard, tough. Cabinet work, and probably engraving. New South Wales, New Caledonia.

Claoxylon australe, Bail. Similar. New South Wales.

Mallotus claoxyloides, Muell. Arg. Bright-yellow. New South Wales.

M. philippinensis, Muell. Arg. "Kamela tree," "Poodgee poodgera." Straw-colour, hard, very tough. New South Wales and Tropical Asia.

M. polyadenus, F. v. M. Light-yellow, brown heart.

M. discolor, F. v. M. Light-yellow, tough. A dye from fruit.

Macaranga inamœna, F. v. M. Light-coloured, tough.

M. involucrata, Bail. Very light and soft.

M. Tanarius, Muell. Arg. "Tumkullum." Light-colour, close-grained, soft. New South Wales and Eastern Tropics.

Excœcaria Agallocha, L. "Milky mangrove," "River poison tree." Light-coloured, soft. New South Wales and Tropical Asia.

E. Dallachyana, Bail. "Scrub poison tree." Yellow, black heart, very tough. Axe handles?

E. parviflora, Muell. Arg. "Gutta-percha tree," "Jil leer." Yellow, dark heart, beautifully marked. Cabinet work. North Australia.

Celtis philippinensis, Blanco. (*Urticaceæ.*) Light-coloured, hard. China and Indian Archipelago.

Trema aspera, Blume. "Peach-leaf poison-bush." Whitish, soft, light. North Australia and New South Wales.

T. orientalis, Blume. "Charcoal tree of India." Red, soft, resembling cedar. New South Wales, India.

Aphananthe philippinensis, Planch. Light-coloured, close-grained. New South Wales, Philippines.

Pseudomorus Brunoniana, Bureau. Light-yellow, hard, tough. New South Wales and New Caledonia.

Ficus Cunninghamii, Miq. Light-coloured, soft.

F. platypoda, A. Cunn. Light-yellow, soft, fibrous.

F. aspera, Forst. "Rough," or "Purple fig." Similar. New South Wales.

F. pleurocarpa, F. v. M. "Johnstone River ribbed fig." Light, soft, elastic, with very open pores.

F. glomerata, Willd. Straw-colour, coarse-grained, soft, light. North Australia and India.

Cudrania javanensis, Tréc. "Cockspur thorn." Dark-yellow. Cabinet work. New South Wales, India, etc.

Laportea gigas, Wedd. "Large stinging-tree." Brownish, spongy. New South Wales.

L. photiniphylla, Wedd. "Shiny-leaved stinging-tree." Similar. New South Wales.

Pipturus argenteus, Wedd. "Coomeroo coomeroo." Brown, soft. Good fibre from bark. New South Wales and the islands of the Archipelago and Pacific.

Casuarina glauca, Sieb. (*Casuarineæ.*) "Swamp oak," "Billa." Red, beautifully marked, hard, tough. Cabinet work. South-East Australia.

C. equisetifolia, Forst. Dark, nicely marked, coarse-grained. Eastern Tropics. Var. *incana*. "Wunna wunnarumpa." Lighter.

C. suberosa, Ott. et Dietr. Dark-brown, prettily marked, coarse-grained, tough. Yokes, etc. East Australia.

C. Cunninghamiana, Miq. Similar. New South Wales.

C. inophloia, F. v. M. "Thready-barked oak." Reddish, with numerous dark marks, very beautiful. Cabinet.

C. torulosa, Ait. "Forest oak," "Beefwood," "Koondeeba." Red, nicely marked, hard. Yokes. New South Wales. South Australia.

Dracæna angustifolia, Roxb. (*Liliaceæ.*) Outer, hard part, light-coloured. North Australia and New Guinea.

Xanthorrhœa arborea, R. Br. (*Juncaceæ.*) "Grass tree," "Black boy." Outer part straw-colour, cross-grained, yielding gum; inner yielding sugar. New South Wales.

Archontophœnix Cunninghamii, Wendl. & Drude. (*Palmæ.*) "Piccabeen." Outer part very hard and prettily marked. New South Wales.

Ptychosperma Normanbyi, F. v. M. "Black palm." Black, very hard, beautifully marked. Walking sticks.

Licuala Muelleri, Wendl. & Drude. Marked with narrow black lines, hard.

Livistona humilis, R. Br. Light-coloured, hard. North Australia.

L. inermis, R. Br. Light-grey, with darker streaks.

L. australis, Mart. "Common cabbage palm." Light-coloured. East Australia.

Pandanus pedunculatus, R. Br. (*Pandaneæ.*) "Breadfruit," "Wynnum." Light-coloured, prettily marked. Fibre from leaves and roots. New South Wales.

Callitris Parlatorei, F. v. M. (*Coniferæ.*) "Stringy-bark pine." Straw-colour, soft, fragrant. New South Wales.

C. robusta, R. Br. "Cypress pine." Light to dark brown, streaked with pink; teredo-proof; fragrant, very durable. Piles and cabinet work. All the colonies. Var. *microcarpa*, "Pooragri," "Coolooli." Dark, fragrant, durable; teredo-proof. New South Wales.

C. rhomboidea, R. Br. "Brorogery." Light-coloured, durable. Similarly employed. South-East Australia.

C. calcarata, R. Br. Light-coloured, fine-grained, prettily marked. Joinery. East Australia.

Podocarpus elata, R. Br. "She pine," "Kidneywallum." Light-yellow, strong, durable. Masts, etc. New South Wales.

Agathis robusta, Salisb. (= *Dammara*). "Dundathu" or "Kauri pine." Light-yellow, soft; largely used.

Araucaria Cunninghamii, Ait. "Moreton Bay" or "Hoop pine," "Cumburtu," "Coonam." Straw-colour, strong, durable. Flooring. New South Wales.

A. Bidwilli, Hook. "Bunya-bunya pine." Light-coloured, often prettily marked, strong, durable, takes a good polish; largely used.

Cycas media, R. Br. (*Cycadaceæ.*) Outer part stringy, inner spongy. North Australia.

Alsophila australis, R. Br. (*Filices.*) "Common tree fern," "Nangananga." Wood brown, very hard. East Australia.

A. Leichhardtiana, F. v. M. "Prickly tree fern." Wood black, very hard. New South Wales.

Dicksonia Youngiæ, C. Moore. Wood black, very hard. New South Wales.

New South Wales.

Estimated to contain, in 1875, 82,700,000 acres of indigenous timber, the forests of that colony, the variety of whose vegetable productions earned for it, in 1788, the name of Botany Bay, are chiefly Myrtaceous—*Eucalyptus*, *Angophora*, *Tristania*, *Syncarpia*, and *Melaleuca* being their chief genera; whilst the species are mainly identical with those of Temperate Queensland. The local names are, however, distinct. "Cedar" (*Cedrela australis*) and pine (*Araucaria Cunninghamii*) are the only timbers exported, the markets being China and New Caledonia, and the area under the former tree is rapidly diminishing. The timber land is, however, largely in the hands of Government. Other principal species are:

—*Podocarpus spinulosus*, "Colonial deal;" *Flindersia australis*, "Flindosa," "Wyagerie," "Cugerie," "beech," or "ash;" *Eucalyptus siderophloia*, "Ironbark," the strongest and most durable wood in the colony; *E. botryoides*, "Blue gum," but not the species so called in Victoria and Tasmania; *E. hæmastoma*, "Spotted gum;" *E. rostrata*, "Flooded gum;" *E. hemiphloia*, "White Box;" *E. corymbosa*, "Yellow box," "Bloodwood;" *E. obliqua*, "Messmate" or "Stringy bark;" *E. amygdalina*, or *E. Sieberiana*, "Mountain Ash;" *E. robusta*, "Mahogany;" *E. pilularis*, "Black butt;" *E. resinifera*, "Red gum;" *Syncarpia laurifolia*, "Turpentine-tree," which is teredo-proof and almost uninflammable; *Acacia pendula* and *A. homalophylla*, the fragrant "Myalls;" *A. melanoxylon*, "Blackwood;" *Ceratopetalum apetalum*, "Coachwood" or "Lightwood;" and *Casuarina tenuissima*, "Oak." The Kew Collection contains a fine series of New South Wales woods, 110 being enumerated in the "Official Guide," mostly with local names, but including many undetermined species of *Eucalyptus*. Those which are specifically determined, but which do not bear the same names in the Queensland list, are as follows:—

Acacia binervata, DC. "Myimbarr," "Black wattle." (*Leguminosæ.*)
A. Cunninghamii, Hook. "Bastard Myall."
A. falcata, Willd. "Wee-tjellan," "Hickory lignum-vitæ."
A. glaucescens, Willd. "Kaareewan."
Acronychia Baueri, Schott. "Beudding," "Turmeric." (*Rutaceæ.*)
Alphitonia excelsa, Reissek. "Nono Gwyinandic" or "Cooper's wood." (*Rhamneæ.*)
Angophora subvelutina, F. v. M. "Illarega," "Apple tree." (*Myrtaceæ.*)
Aphanopetalum resinosum, Endl.? "Tdjeunen," "White Myrtle," "Blue Ash."
Baloghia lucida, Endl. "Nun Naia." (*Euphorbiaceæ.*)
Banksia integrifolia, L. fil. "Courridjah," "Coast Honeysuckle." (*Proteaceæ.*)
Callistemon salignus, DC. "Bood Joong," "Broad-leaved tea tree." (*Myrtaceæ.*)
Cargillia pentamera, F. v. M. "Ulla Wabie," "Black Myrtle." (*Ebenaceæ.*)
Castanospermum australe, A. Cunn. "Irtalic." (*Leguminosæ.*)
Casuarina torulosa, Ait. "Noo Loi." (*Casuarineæ.*)
C. suberosa, Ott. & Dietr. "Dahl Wah," "Forest Oak," "Beefwood."
Cedrela Toona, Roxb. "Woolia." (*Meliaceæ.*)
Ceratopetalum apetalum, Don. "Boola," "Ngnaare-wing," "Leather jacket," "Lightwood," "Coachwood." (*Saxifragaceæ.*)
Cryptocarya obovata, R. Br. "Myndee," "White sycamore." (*Laurineæ.*)
Cupania anacardioides, A. Rich. "Burrunedura," "Tamarind tree." (*Sapindaceæ.*)

C. pseudorhus, A. Rich. "Iccaaya."
C. xylocarpa, A. Cunn. "Wootaric."
Daphandra micrantha, Benth. "Tdundambie." (*Monimiaceæ.*)
Doryphora Sassafras, Endl. "Tdjeundegong," "Caalang," "Sassafras." (*Monimiaceæ.*)
Duboisia myoporoides, R. Br. "Ngmoo," "Cork wood." (*Solanaceæ.*)
Dysoxylon Lessertianum, Benth. (*Meliaceæ.*)
Endiandra glauca, R. Br. "Murrogun," "Teak." (*Laurineæ.*)
E. virens, F. v. M. "Ullagal mabbie," "Bat and ball," "Native orange" or "Pomegranate."
Eucalyptus corymbosa, Sm. "Bourrayero gourroo;" "True," or "Yellow box," "Blood-wood." (*Myrtaceæ.*)
Eugenia myrtifolia, Sims. "Urri-ilbie." (*Myrtaceæ.*)
Ficus macrophylla, Desf. "Waabie," "Moreton Bay fig." (*Moreæ.*)
F. rubiginosa, Desf. "Dthaaman," "Port Jackson fig."
Flindersia Greavesii, Moore. "Wyagerie." (*Meliaceæ.*)
F. Oxleyana, F. v. M. "White teak," "Wyagerie," "Yellow-wood."
Frenela Macleayana, Parlat. "Port Macquarie pine." (*Coniferæ.*)
F. robusta, A. Cunn., var. *verrucosa*. "Coorong," "Cypress pine."
Geijera salicifolia, Schott. "Balsam of capivi tree." (*Rutaceæ.*)
Grevillea Hilliana. "Silky Oak." (*Proteaceæ.*)
G. robusta, A. Cunn. "Warra-garria."
Harpullia pendula, Planch. "Moulubie." (*Sapindaceæ.*)
Jacksonia scoparia, R. Br. "Montangarra." (*Leguminosæ.*)
Laportea gigas, Wedd. "Goo mao mah," "Nettle-tree." (*Urticaceæ.*)
Melaleuca ericæfolia. "White" or "Swamp tea-tree."
M. styphelioides, Sm. "Naambarr," "Prickly tea-tree." (*Myrtaceæ.*)
M. uncinata, R. Br. "Yaangarra," "Tea-tree."
Mooria campylosperma, F. v. M. "Urra Wymbie."
Myrtus Becklerii, F. v. M. "Ginugal." (*Myrtaceæ.*)
Nephelium tomentosum, F. v. M. "Uroobie." (*Sapindaceæ.*)
Olea paniculata, R. Br. "Lariundie," "Marblewood." (*Oleaceæ.*)
Owenia venosa, F. v. M. "Moulubie," "Tulip wood." (*Meliaceæ.*)
Pittosporum undulatum, Vent. "Wallandun deyren." (*Pittosporeæ.*)
Podocarpus elata, R. Br. "Dyrren dyrren," "White pine." (*Coniferæ.*)
Rhodamnia trinervia, Blume. "Red scrub tea tree," "Three-veined myrtle." (*Myrtaceæ.*)
Sideroxylon australis, Benth. & Hook. "Wycanlie," "Native Plum." (*Sapotaceæ.*)
Stenocarpus salignus, R. Br. "Meleyn," "Beefwood." (*Proteaceæ.*)
S. sinuatus, Endl. "Yiel yiel."
Sterculia fœtida, L. "Stave-wood." (*Sterculiaceæ.*)
Synoum glandulosum, A. Juss. "Mocoundie," "Rosewood," "Pencil cedar," "Turnip-wood." (*Meliaceæ.*)
S. Lardneri. "Pencil cedar." Scentless.
Tarrietia argyrodendron, Benth. "Iron-wood." (*Sterculiaceæ.*)
Tristania conferta, R. Br. "Red," "Brush," or "Bastard box." (*Myrtaceæ.*)
T. neriifolia, R. Br. "Ooramilly," "Water gum."

Trochocarpa laurina, R. Br. "Barranduna," "Beech," "Brush cherry." (*Epacridaceæ.*)

Weinmannia rubifoliæ, F. v. M. "Marara," "Cork-wood." (*Saxifragaceæ.*)

Xylomelum pyriforum, Knight. "Meridjacourboo." (*Proteaceæ.*)

[See Moore, "Woods of New South Wales."]

Victoria.

Nearly half the area of the colony of Victoria (40,000 out of 88,198 square miles) was estimated in 1878 as forest, most of which is in the hands of Government. The great bulk of the timber consists of *Eucalyptus*, the chief species of which cover more than half the forest area. The acacias are second in importance. The "Red gum" (*Eucalyptus rostrata*, Schlecht.), sp. gr., ·858 to ·923, is the most valuable hardwood in the colony, being very durable. It is used for piles, bridge-planks, railway-sleepers, ships'-knees, etc., besides yielding kino, paper-pulp, charcoal, pearl-ash, tar, etc. The "blue gum" (*E. globulus*, Labill.) is scarcer (sp. gr., ·698 to ·889), but is similarly used. Its colossal size adapts it for outside planking. The "white gum" (*E. amygdalina*, Lab.)—also known as "mountain ash," "peppermint," or "giant gum"—exceeds 400 feet in height, but is less durable. The "messmate stringy-bark" (*E. obliqua*, L'Hérit.), sp. gr., ·809 to ·990,—by far the most abundant and most generally used timber in the colony—is inferior, being liable to twist; and the "iron-bark" (*E. leucoxylon*, F. v. M. = *E. Sideroxylon*, A. Cunn.), sp. gr., 1·106 to 1·024, is considered the strongest wood in the colony, but is much smaller in size. It is used for cogs, spokes, shafts, and axe-handles. There is a small series of Victorian timbers at Kew; but the following enumeration of the remaining species is taken from the valuable descriptive list in the "Catalogue of Victorian Exhibits: Indian and Colonial Exhibition," where the woods were most admirably displayed:—

Acacia decurrens, Willd. "Common," "Black," or "Feathery Wattle." Sp. gr., ·727 to ·773. Gum and bark for tanning. (*Leguminosæ.*)

A. dealbata, Link. "Silver Wattle."

A. homalophylla, A. Cunn. "Myall." Fragrant. Gum.

A. implexa, Benth. Sp. gr., ·711.

A. leprosa, Sieber. "Native hickory." Cabinet work.

A. lincaris, Sims.

A. longifolia, Willd.

A. melanoxylon, R. Br. "Blackwood," "Lightwood." Sp. gr., ·664 to ·777. A plentiful and valuable wood. Heavy, close-grained, beautifully marked, taking a polish.

A. penninervis, Sieb.

A. pycnantha, Benth. "Golden wattle." Sp. gr., ·830. Bark and gum.

A. salicina, Lindl. Sp. gr., ·763. Dark, hard, heavy, durable.

A. verticillata, Willd. Turnery.

Angophora intermedia, DC. "Spurious apple tree." (*Myrtaceæ.*)

Aster argophyllus, Labill. "Musk-tree." Sp. gr., ·642. Fragrant, mottled wood for veneers or turnery. (*Compositæ.*)

A. glandulosus, Labill.

Atherosperma moschatum, Labill. "Victorian sassafras." (*Monimiaceæ.*)

Avicennia officinalis, L. "Native mangrove." (*Verbenaceæ.*)

Banksia marginata, Cav. (=*B. australis*, R. Br.). "Honeysuckle tree." Sp. gr., ·610. Beautifully grained. (*Proteaceæ.*)

B. integrifolia, L. fil. "Coast honeysuckle." Sp. gr., ·799. Similar, but much larger.

B. serrata, L. fil. Sp. gr., ·803. Similar. Small.

Bertya Findlayi, F. v. M. (*Euphorbiaceæ.*)

Bursaria spinosa, Cav. "Prickly box tree." Turnery. (*Pittosporeæ.*)

Callitris cupressiformis, Vent. (=*Frenela rhomboidea*, Endl.). "The mountain cypress pine," "Oyster Bay pine." (*Coniferæ.*)

C. verrucosa, R. Br. (=*Frenela robusta*, A. Cunn.). "Desert sandarac pine," "Cypress," "Murray pine." Sp. gr., ·691. Dark, beautiful, durable. Yields gum sandarac.

Casuarina glauca, Sieb. "Desert she-oak," "Beefwood." (*Casuarineæ.*)

C. quadrivalvis, Labill. "Drooping she-oak," "Beefwood." Sp. gr., ·935 to 1·037. Variously employed.

C. suberosa, Otto & Dietr. "Straight she-oak," "Beefwood."

Coprosma microphylla, A. Cunn. (*Rubiaceæ.*)

Dodonæa viscosa, L. (*Sapindaceæ.*)

Drimys aromatica, F. v. M. (=*Tasmannia aromatica*, R. Br.). "Native pepper tree." (*Magnoliaceæ.*)

Eriostemon squameus, Labill. (*Rutaceæ.*)

Eucalyptus Behriana, F. v. M. (*Myrtaceæ.*)

E. botryoides, Sm. "Bastard mahogany." Ship-building.

E. corymbosa, Sm. "Bloodwood."

E. goniocalyx, F. v. M. "Spotted," "Blue," or "White Gum," or "Bastard box." Hard, variously useful.

E. Gunnii, Hook. fil. "Swamp gum," "Cider tree." Cider from sap.

E. hemiphloia, F. v. M. "White" or "Grey box."

E. incrassata, Labill.

E. longifolia, Link. & Otto. "Woolly-butt." Sp. gr., 1·187. Durable, for fences or furniture.

E. macrorhyncha, F. v. M. "Stringybark." Durable.

E. melliodora, A. Cunn. "Yellow box." Sp. gr., 1·081 to 1·125. Light-coloured, tough, greasy. Cogs, screws, naves.

E. odorata, Behr. "Peppermint tree."

E. oleosa, F. v. M. "Water-rooted gum tree."

E. pauciflora, Sieb. "Mountain white gum."

E. piperita, Sm. "White stringybark."

E. polyanthema, Schauer. "Red" or "Grey box," "Poplar-leaved gum."

E. Sieberiana, F. v. M. "Mountain ash," "Gum-top," "Iron-bark."

E. stellulata, Sieb. "Box;" "White," "Lead," or "Green gum."

E. Stuartiana, F. v. M. "Apple-scented eucalypt."

E. viminalis, Lab. "Manna," "Drooping" or "White gum," "Black butt." Sp. gr., ·685.

Eugenia Smithii, Poir. (=*Acmena floribunda*, Sm.). "Myrtle tree." Sp. gr., ·898 to ·935. (*Myrtaceæ.*)

Exocarpus cupressiformis, Lab. "Native cherry." Sp. gr., ·756 to ·845. Soft, carving, turnery, etc. (*Santalaceæ.*)

Fagus Cunninghami, Hook. fil. "Evergreen beech," "Native myrtle." Sp. gr., ·883. Cogs, cabinet work, ornamental. (*Cupuliferæ.*)

Hakea eriantha, R. Br. (*Proteaceæ.*)

Hedycarya Cunninghami, Tul. "Native mulberry." (*Monimiaceæ.*)

Helichrysum ferrugineum, Less. (=*Ozothamnus*, R. Br.). (*Compositæ.*)

Kunzea pedunculuris, F. v. M. (*Myrtaceæ.*)

Leptospermum lævigatum, F. v. M. (=*Fabricia*, Gaertn.). "Coast tea tree." (*Myrtaceæ.*)

L. lanigerum, Sm.

L. scoparium, Forst.

Leucopogon Richei, R. Br. (=*Styphelia*, Lab.). (*Epacridaceæ.*)

Lomatia Fraseri, R. Br. Sp. gr., ·678. Tough. Furniture. (*Proteaceæ.*)

L. longifolia, R. Br. Turnery.

Melaleuca ericifolia, Sm. "Swamp tea tree." Yields an oil resembling cajeput. (*Myrtaceæ.*)

M. parviflora, Lindl. (=*M. curviflora*, Schl., and *M. Preissiana*, Schauer). Sp. gr., ·993. Oil.

M. squarrosa, Sm. "Swamp tea tree."

Myoporum insulare, R. Br. Sp. gr., ·809 to ·819. (*Myoporineæ.*)

Myrsine variabilis, R. Br. Sp. gr., ·714. (*Myrsineæ.*)

Notelæa ligustrina, Vent. "Spurious olive." (*Oleaceæ.*)

Panax Murrayi, F. v. M. "Palm panax." Sp. gr., ·348. (*Araliaceæ.*)

P. sambucifolius, Sieb.

Persoonia arborea, R. Br. (*Proteaceæ.*)

P. linearis, R. Br. Veneers.

Pittosporum bicolor, Hook. "White wood." Sp. gr., ·874. (*Pittosporeæ.*)

P. undulatum, Vent. Suitable for engraving.

Plagianthus pulchellus, Gray (=*Sida*, Bonp.). "Currijong." (*Malvaceæ.*)

Pomaderris apetala, Labill. Sp. gr., ·772. Carving. (*Rhamnaceæ.*)

Prostanthera lasianthos, Labill. "Mint tree." Sp. gr., ·809. (*Labiatæ.*)

Santalum acuminatum, DC. "Native peach," "Quandong." Sp. gr., ·828. Suitable for engraving. Fruit edible. (*Santalaceæ.*)

Senecio Bedfordii, F. v. M. (=*Bedfordia salicina*, DC.). "Native dogwood." Sp. gr., ·896. Turnery. (*Compositæ.*)

Tristania laurina, R. Br. Tough. Cogs. (*Myrtaceæ.*)

Through the instrumentality of Baron Ferdinand von Müller, to whom Australian botany is so deeply indebted, several valuable exotic species, such as the Douglas fir, the Deodar, and the Wellingtonia, have been successfully introduced into Victoria.

South Australia.

As in Victoria, so in South Australia, the *Eucalypti*, misleadingly termed "gum trees," since their produce is not a gum, but a kino, form the staple of the timber supply. *Casuarina*, or "oak," yields woods suitable for axe-handles, spokes, etc. *Acacia melanoxylon* is the most useful of some thirty species of that genus; and there is a native "pine" (*Callitris robusta*), the wood of which, however, is not durable. The forest area is not large. The chief species, as represented at the Colonial and Indian Exhibition, are the following:—

Acacia aneura, F. v. M. "Mulga."
A. decurrens, Willd. "Black wattle."
A. homalophylla, A. Cunn. "Myall."
A. melanoxylon, R. Br. "Blackwood."
A. pycnantha, Benth. "Broad-leaf wattle."
A. retinodes, Schlecht. "Silver wattle."
A. salicina, Lindl. "Broughton willow."
Banksia marginata, Cav. "Honeysuckle."
Bursaria spinosa, Cav. "Native box."
Callitris robusta, R. Br. "Native pine."
Casuarina glauca, Sieb. "Black oak."
C. quadrivalvis, Labill. "She oak."
Eremophila longifolia, F. v. M.
Eucalyptus capitellata, Sm. "Head-flowered stringybark."
E. coccifera, Hook. fil.
E. corynocalyx, F. v. M. "Sugar gum."
E. goniocalyx, F. v. M. "Bastard box."
E. hemiphloia, F. v. M. "Box gum."
E. leucoxylon, F. v. M. "Blue gum."
E. maculata, Hook. "Marbled gum."
E. obliqua, L'Hérit. "Stringybark."
E. odorata, Behr. "Peppermint gum."
E. paniculata, Sm. "Swamp gum."
E. rostrata, Schlecht. "Red gum."
E. Stuartiana, F. v. M.
E. viminalis, Lab. "Manna gum."
Exocarpus cupressiformis, Lab. "Native cherry."
Grevillea robusta, A. Cunn.
Livistona australis, Mart. "Northern Territory cabbage-palm."
Melaleuca leucadendron, L. "Milkwood."
M. squarrosa, Sm. "Bottle-brush tea tree."
Pittosporum phillyræoides, DC. "Poison-berry tree."

Here, too, various European species have been introduced, chiefly by Sir R. Schomburgk, such as elm, ash, plane, false acacia, and Aleppo pine.

West Australia.

Comprising, as it is estimated to do, over a million square miles, the whole of West Australia may be said to be forest, but nearly

all the heavy timber occurs in the central and south-western districts, south of latitude 31°. A large amount of timber is annually exported, especially "Sandal-wood" (*Fusanus spicatus*) and the magnificent "Jarrah" (*Eucalyptus marginata*). This last species predominates over an area estimated at 14,000 square miles, the "White gum" (*E. viminalis*) covering 10,000, the "Karri" and "York" gums (*E. diversicolor* and *E. loxophleba*) jointly some 5000, the "Red gum" (*E. robusta*) some 800, and the "Tooart" or "Tewart" (*E. goniocephalus*) some 500 square miles. Other species are :—

Acacia acuminata, Benth. "Jam" or "Raspberry scented acacia."
Banksia.
Casuarina.
Eucalyptus calophylla, R. Br. "Mahogany."
E. colossea. "Karri."
E. redunca, Schau. "Wandoo."
E. rostrata, Cav. "Red gum."[1]

Tasmania.

Nearly one-half of Tasmania (eight million acres) is timbered, and of this area one-eighth is, perhaps, in private hands, though the area is diminishing. The bulk of the timber exported consists of "Stringybark" (*Eucalyptus obliqua*), sent in planks to Victoria, South Australia, and New Zealand; but the most valuable timber of the colony is the "Blue gum" (*E. globulus*), abundant in the south, and very hard and strong, though of rapid growth.[2] Tasmanian woods having been fully represented at the International Exhibition of 1862, there is a fairly complete series at Kew. The following list is taken mainly from the "Official Guide" :—

Acacia dealbata, Link. "Silver wattle." Used for oars and turnery, and yielding gum and tannin. (*Leguminosæ.*)

A. decurrens, Willd., var. *mollissima.* "Black wattle."

A. melanoxylon, R. Br. "Blackwood." Hard, durable, and abundant. Sp. gr., ·885.

Athrotaxis selaginoides, Don. "Cedar." (*Coniferæ.*)

Banksia marginata, Cav. "Honeysuckle." Reddish, well marked. Cabinet work and flooring. (*Proteaceæ.*)

Bedfordia salicina, DC. "Dogwood." Brown, close-grained, well marked, but used mainly as fuel. (= *Senecio Bedfordii*, F. v. M. *Compositæ.*)

Casuarina stricta, Ait.; *C. quadrivalvis*, Labill.; and *C. suberosa*, Otto and Dietr. The "She oaks" or "Beefwoods." Used for furniture, but mainly as fuel. (*Casuarineæ.*)

Dacrydium Franklinii, Hook. fil. "Huon pine." Light-yellow, beauti-

[1] Rogers, *op. cit.*, p. 27. [2] *Ibid.*, p. 29.

fully mottled, tough, durable, taking a good polish. Used for ship and house building, but superior to European, American, or New Zealand pines as a cabinet wood. Sp. gr., ·650. (*Coniferæ.*)

Eucalyptus amygdalina, Lab. "Peppermint gum." (*Myrtaceæ.*)

E. globulus, Lab., *E. obliqua*, L'Hérit.

E. viminalis, Lab. "Swamp" or "White gum." An inferior, but abundant species.

Fagus Cunninghami, Hook. "Native myrtle." Sp. gr., ·795. Perishable. Furniture. Northern Tasmania. (*Cupuliferæ.*)

Hakea acicularis, R. Br., var. *lissosperma*. "Native pear." Hard. Turnery. (*Proteaceæ.*)

Leptospermum lanigerum, Sm. "Tea tree." (*Myrtaceæ.*)

Notelæa ligustrina, Vent. "Ironwood," "Heart-wood." Very hard, centre like olive. Mallets, blocks, etc. (*Oleaceæ.*)

Olearia argophylla, F. v. M. (=*Eurybia*). "Muskwood." (*Compositæ.*)

Phyllocladus rhomboidalis, Rich. "Celery-topped pine." Masts, etc. (*Coniferæ.*)

Pittosporum bicolor, Hook. "Whitewood." Formerly used for native clubs, and probably suitable for engraving. (*Pittosporeæ.*)

[See J. D. Hooker, "Flora of Tasmania."]

New Zealand.

"One of the richest portions of the globe as regards arboreous vegetation is the colony of New Zealand. It enjoys a climate similar to that of the south of Europe; the vegetation is most luxuriant, and many tropical plants flourish, while conifers, characteristic of colder regions, also abound. In Britain the number of indigenous timber trees is only 35 out of a flora of 1400 species; while New Zealand has 113 timber trees in a flora of only 1000 species."[1] The forest area of New Zealand was estimated at over twenty million acres in 1830, and only twelve million acres in 1874, clearing then proceeding at the rate of 4 per cent. per annum. The forests which are not still in the hands of the Maories, are, however, mainly in those of Government; and conservation has now been inaugurated. By far the most valuable tree in New Zealand is the "Kauri" (*Dammara australis*, Lamb.), which is confined to North Island. It grows 120 or even 200 feet high, with a diameter of 10 to 20 feet, is very strong and durable, though not teredo-proof, is sometimes richly mottled, and has long been used in our dockyards for masts and spars. It also yields the valuable Kauri gum. Species of pine and beech characterise South Island, and the latter predominates on Stewart Island.

[1] Dr Cleghorn, "Encycl. Brit.," vol. ix., p. 407.

The following are the chief species :—

Alectryon excelsum, DC. "Titoki." Resembling ash. Coach-building, wheels, etc. (*Sapindaceæ.*)

Aristotelia racemosa, Hook. fil. "Makomako," "Currant tree." Ornamental. (*Tiliaceæ.*)

Atherosperma novæ-Zelandiæ, Hook. fil. "Pukatea." Very light. Boat-building and furniture. (*Monimiaceæ.*)

Beilschmiedia Tarairi, Benth. & Hook. (=*Nesodaphne*, Hook. fil.). "Taraire." Hard, takes a good polish. Furniture. (*Laurineæ.*)

B. Tawa, Benth. & Hook. "Tawa." Similar.

Corynocarpus lævigata, Forst. "Karaka." Furniture. (*Anacardiaceæ.*)

Dacrydium Colensoii, Hook. "Manoao," "Golden" or "Yellow pine" (=*Podocarpus*). Building. (*Coniferæ.*)

D. cupressinum, Soland. "Rimu," "Red pine." The most abundant species. Perishable. Building.

D. intermedium. "Manoao," "Yellow silver pine." Bridges, piles.

Dammara australis, Lamb. "Kauri." (*Coniferæ.*)

Dodonæa viscosa, Forst. "Ake-ake." Veneers, axe handles. (*Sapindaceæ.*)

Elæocarpus dentatus, Vahl. "Hinau." Light-brown, strong, tough, durable. Fencing, sleepers, etc. (*Tiliaceæ.*)

Entelea arborescens, R. Br. "Whau." Fishing floats. (*Tiliaceæ.*)

Fagus fusca, Hook. fil. "Hutu-tawhai," "Red birch." (*Cupuliferæ.*)

F. Menziesii, Hook. fil. "Silver birch."

F. Solandri, Hook. fil. "Tawhai," "Black birch." Bridge building, fences, etc. Hard, durable, abundant.

Griselinia littoralis, Raoul. "Broadleaf." Fencing. (*Cornaceæ.*)

Hedycarya dentata, Forst. "Kaiwhiria." (*Monimiaceæ.*)

Hoheria populnea, A. Cunn. "Powhiwhi," "Ribbon-wood" or "Lace bark." Furniture. (*Malvaceæ.*)

Knightia excelsa, R. Br. "Rewa rewa," "Honeysuckle." Habit of Lombardy poplar. Inlaying. Perishable. (*Proteaceæ.*)

Leptospermum ericioides, A. Rich. "Manuka," "White tea tree." Hard, with dark markings. Piles, fences, and wheels, but fit for cabinet work. (*Myrtaceæ.*)

L. scoparium, Forst. "Manuka." Furniture, etc.

Libocedrus Bidwillii, Hook. fil. "Pankatea" or "Pahantea," "Cedar." (*Coniferæ.*)

L. Doniana, Endl. "Kawaka," "Cypress." Furniture.

Metrosideros lucida, Menz. "Ironwood," } "Rata." (*Myrtaceæ.*)
M. robusta, A. Cunn. }
Very dense and durable. Abundant. Shipbuilding, etc.

M. tomentosa, A. Cunn. "Pohutukawa." Heavy, durable. Shipbuilding, etc.

Myoporum lætum, Forst. "Ngaio." Furniture. (*Myoporineæ.*)

Myrsine Urvillei, A. DC. "Mapau," "Matipo," "Red Maple." Furniture, fuel. (*Myrsineaceæ.*)

Myrtus bullata, Banks & Sol. "Ramarama." (*Myrtaceæ.*)

Olea Cunninghamii, Hook. fil. "Black maire." Hard, durable. Variously employed. The strongest native wood. (*Oleaceæ.*)

Olearia Traversii, F. v. M. "Bastard sandal-wood." (*Compositæ.*)

Panax crassifolium, Dec. & Planch. "Horoeka," "Grass tree," "Lance-wood." Tool handles. (*Araliaceæ.*)

Pittosporum eugenioides, A. Cunn. "Tarata," "Turpentine." Furniture. (*Pittosporeæ.*)

P. tenuifolium, Banks & Sol. "Mapau," "Black maple."

Phyllocladus alpinus, Hook. fil. "Toatoa." Furniture, etc. (*Coniferæ.*)

P. trichomanoides, Don. "Tanekahe," "Celery pine." Strong, durable in damp. Sleepers, etc. Tannin.

Plagianthus betulinus, A. Cunn. "Powhiwhi," "Lace bark." (*Malvaceæ.*)

Podocarpus dacrydioides, A. Rich. "Kahikatea," "White pine." Abundant, white, tough. Canoes, etc. (*Coniferæ.*)

P. ferruginea, Don. "Miro," "Bastard black pine." Reddish, durable. piles.

P. spicata, R. Br. "Matai," "Black pine." Abundant, yellowish, very durable. Piles, sleepers, building.

P. Totara, A. Cunn. "Totara." Very durable; a substitute for mahogany. Sleepers, piles, etc.

Quintinia serrata, A. Cunn. "New Zealand lilac." (*Saxifragaceæ.*)

Santalum Cunninghamii, Hook. fil. "White Maire." Engraving. (*Santalaceæ.*)

Sapota costata, A. DC. "Pau," "New Zealand box." (*Sapotaceæ.*)

Sophora tetraptera, Ait. "Kowhai." Fencing, etc. (*Leguminosæ.*)

Tetranthera calicaris, Hook. fil. "Mangeao." Tough. Ships' blocks. (*Laurineæ.*)

Vitex littoralis, A. Cunn. "Puriri," "New Zealand teak." Extremely strong, heavy. Sleepers, piles, etc. (*Verbenaceæ.*)

Weinmannia racemosa, Forst. "Kamai." Sleepers. (*Saxifragaceæ.*)

Conclusion.

Such may be said to be a general summary of the names and economic uses, so far as they are yet known, of the timber trees of the world. A vast amount of investigation, however, has still to be made, before an accurate estimate of the properties and uses of every forest tree can be formed. Valuable as vernacular names often prove as a means of identifying plants, and especially timbers, enough has been here said to show how frequently they are but vaguely or even mistakenly applied, even by natives, and how practically important it is to be able to discriminate with scientific accuracy the various "ebonies," "ironwoods," "red-woods," "yellow-woods," "cedars," "pines," and "gum trees" of different countries.

XIX. *The Native Trees and Shrubs of Carnarvonshire.* By Angus D. Webster, Forester, Penrhyn Castle, Bangor, Wales.

Having devoted considerable attention to the finding out of such trees and shrubs as may, so far as is known, be considered natives of this county, I have thought the subject not unworthy of the following brief remarks, more particularly as at least one species (*Cotoneaster vulgaris*) has been found wild in no other part of the British Isles.

Taking into consideration that the area of Carnarvonshire is little over 370,000 acres, of which more than one-half is under crop, and that no less than 78 species and varieties of trees and shrubs are found therein, it will be seen that no other corresponding area of ground in Britain, nor, indeed, any single county, can boast of so rich a flora.

Of the 78 species above mentioned, 24 may be classed as timber trees and the remaining 54 as shrubs proper, regarding the habitat and utility of which we will in turn say a few words. The arrangement of genera and species is according to Bentham's "British Flora."

Ranunculaceæ (One Species).

1. The Traveller's Joy or Old Man's Beard (*Clematis vitalba*). —Few persons who take an interest in out-door flowers can fail to have admired our native Traveller's Joy, which in many parts of England runs over the hedges and bushes, loading them first with its fragrant greenish-white flowers, and afterwards with an abundance of conspicuous silky, feathery carpels. It is a straggling climber, the woody stems of which sometimes attain a couple of inches in diameter and a length of several yards, the young branches spreading over trees and shrubs, and to which they become attached by their twisted petioles. In the chalky districts of southern and eastern England it is very abundant, but gradually decreases in quantity as we approach the north, and is, in a truly wild state, rare in Wales and Scotland. The popular names were given by Gerard in 1597—"Traueilers Joie, as decking and adorning waies and hedges, where people travell: Virgin's Bower, by reason of the goodly shadowe which they make with their thick bushing and

climbing; as also for the beautie of the flowers, and the pleasant scent or savour of the same."

The hoary appearance of the silky grey carpels has, no doubt, given rise to the name of "Old Man's Beard." Plentiful in one or two stations near Bangor in a truly wild state.

Berberideæ (One Species).

2. The Common Barberry (*Berberis vulgaris*). — A pretty deciduous shrub, more especially when laden with its orange scarlet fruit or elegant drooping racemes of yellow flowers. It not unfrequently attains a height of 6 ft. to 8 ft., with gracefully arching branches, which are well armed with sharply-toothed ovate leaves. The berries are used for preserves, for garnishing dishes, and encased in sugar are prepared as comfits by confectioners. A yellow dye is prepared from the roots of this plant, and the bark is an "infallible" Welsh remedy for several diseases. Hedges, thickets, and woods are the usual haunts of the plant, but, although generally distributed over Britain, cannot be considered as wild in all districts. Fairly abundant in rocky woods throughout this county.

Cistaceæ (Two Species).

3. The Common Rockcist (*Helianthemum vulgare*), and 4, the Hoary Rockcist (*H. canum*).—These are dwarf undershrubs, with branched, woody stems that rarely exceed 8 in. to 12 in. in height. Flowers bright yellow, and produced in rich profusion throughout the summer, those of *H. vulgare* being larger, as, indeed, is the various parts of the plant, than *H. canum*. The latter is abundant on the limestone rocks of the Great Orme's Head, while *H. vulgare* is plentifully distributed in rocky pastures throughout the county generally.

Hypericineæ (One Species).

5. The Tutsan (*Hypericum Androsæmum*).—A very ornamental shrubby plant, growing 2 ft. to 3 ft. in height, with ovate subcordate leaves, having numerous very minute glandular dots. Whether in flower or fruit this is one of our most showy and attractive woodland plants. It is widely distributed in Britain, occurring in open woods and amongst shrubs, but, in this county

at least, attaining greatest perfection in well-sheltered situations within the influence of the sea. The plant was formerly esteemed for medicinal qualities, and therefore denominated Tutsan, *Toutsaine*, q.d. All-heal. *H. calycinum*, although naturalised in several parts of England, cannot be included amongst our native plants.

Tiliaceæ (One Species).

6. The Common Lime (*Tilia Europæa*).—As to whether or not the lime or linden tree can be reckoned as a native of this country is a point on which even our greatest authorities are by no means agreed, some asserting that it was introduced by the Romans, and others that the first two trees were planted in England in 1590, and are still growing at Halstead, in Kent. The fact of its reproducing itself but very rarely, for it seldom springs up in uncultivated ground after the manner of indigenous trees, certainly favours the opinion of its being an introduced species. It is an ornamental tree, which, although destitute of the picturesque character which distinguishes the oak and some other trees, is, nevertheless, of an elegant habit, and when allowed plenty of room for full development, attains a large size, with a well-balanced head. As a park or avenue tree, the linden has long been a favourite with most European nations, for scarcely a town in either Germany or France wants its shady avenue or public walk composed of this tree; while for the same purpose it is no less popular in our own country.

The wood of the lime is of a pale yellow or white colour, close-grained, light, and smooth, qualities which specially adapt it for a great variety of uses, such as carvings, piano sounding-boards, and for all light work that requires to be partially painted and then varnished over. Gibbons, the celebrated carver in wood, usually employed timber from the lime for his finer works, indeed all the exquisite carvings which he executed for so many churches and palaces in England were of this wood. Of these perhaps the finest specimens are at Chatsworth, Windsor Castle, and in the College Library at Cambridge. For planting in bleak, exposed situations the lime is by no means a suitable tree, its favourite haunts and where it attains greatest perfection being the lower plains and valleys, and in deep, light, rather moist clayey loam.

The common native lime is *T. parvifolia*—a low-growing tree with small glabrous leaves; while that commonly planted is of South European origin, and has much larger leaves, which are downy beneath. It is known as *T. grandifolia*.

Aceraceæ (Two Species).

7. The Common Maple (*Acer campestre*).—A handsome, round-headed tree, usually of smaller size than the sycamore, with smaller reniform leaves and corky back. The timber of this tree is highly valued by the cabinet-maker, for turnery, and for picture frame making, much of it being curiously marked and known as "bird's-eye maple." When beautifully veined, or spotted, it was much prized by the Romans; and of such were composed the celebrated Tigrin and Pantherine tables, some of which are said to have been worth nearly their weight in gold. In Southern England this tree is fairly abundant, but it gradually becomes rarer as we travel northwards.

8. The Great Maple, or Sycamore (*Acer Pseudo-platanus*).—This is a large, handsome tree, with spreading branches and luxuriant massy foliage. Few trees are so well adapted for planting singly on the lawn or pleasure ground, in exposed situations, or within the influence of the sea. Although included in most floras, still the sycamore has but little claim as a native of Britain, and is generally supposed to have been introduced about the middle of the sixteenth century. Turner and Evelyn deny its being indigenous; and Parkinson, in 1640, says—"It is nowhere found wilde or naturall in our land that I can learne, but only planted in orchards or walkes for the shadowes sake." It was little known in England so late as the seventeenth century. Chaucer speaks of it as a rare exotic in the fourteenth century; and Gerard, in 1597, as "a stranger in England, which groweth only in the walkes and places of pleasure of noble-men." The wood is close-grained, susceptible of a high polish, and easily worked. It is used for wooden dishes generally, for cabinet, violin, and piano making, and by wood sculptors, and for founder's patterns. The sycamore is by no means fastidious about soil, thriving well in that of very opposite descriptions, although attaining greatest perfection in that of a light, soft nature, if not surcharged with moisture. It is reproduced in great abundance from seed throughout Britain.

Aquifoliaceæ (One Species).

9. The Common Holly (*Ilex aquifolium*).—This is undoubtedly the handsomest of indigenous trees, but more particularly during winter, when the rich shining evergreen foliage contrasts so beautifully with the bright scarlet berries. From its dense foliage, the

holly yields a large amount of shelter in proportion to the space it occupies, forms an almost impenetrable screen, fence, or hedge, and possesses the valuable quality of thriving vigorously under the shade and drip of other trees. Although most frequently seen as an ornamental shrub or hedge plant, it yet forms a beautiful forest tree of from 40 ft. to 70 ft. in height, numerous instances of which might be pointed out in several of the northern Scottish counties, particularly Moray and Aberdeenshire. In this County the holly is usually met with in the form of a bushy tree or shrub, that is in a wild state, but under cultivation there are specimens upwards of 6 ft. in circumference at a yard up, and fully 50 ft. in height.

As a hedge plant the holly has perhaps no equal, and would, no doubt, be oftener used for that purpose were it not for its slow growth and seeming difficulty to transplant with safety. Famous holly hedges exist in various parts of the country, notably at Tyninghame, in East Lothian, planted in 1712; the Holly Walk, near Farnham, in Surrey; at Colinton House, Midlothian, planted in 1670; at Gordon Castle, Morayshire; and at Taymouth, in Perthshire. Evelyn, it is said, planted a hedge of it at Says Court, near Deptford (at the suggestion of Peter the Great, who resided at his house when he worked in the dockyard at Deptford), 400 ft. long, 9 ft. high, and 5 ft. broad.

The timber is hard, with a fine grain, white as ivory, and susceptible of a fine polish. It is used in veneering, for making mathematical and engineering instruments, for carving and cabinet-making, and, when stained black, as a substitute for ebony.

Rhamnaceæ (One Species).

10. The Common Buckthorn (*Rhamnus catharticus*).—This is a rare shrub, with opposite pairs of spiny branches, and ovate-serrate leaves. On limestone formations in the south of England it is tolerably abundant, but rare in both Scotland and Ireland. In this county I know of only one station where it may be considered as truly wild, and where, according to a manuscript that I have lately seen, it was known upwards of one hundred years ago. Though usually a straggling, many-stemmed bush, of 4 ft. to 5 ft. in height, yet, under favourable circumstances, it has been known to attain the height of nearly 20 feet, and with a stem of 1 ft. in diameter. From the bark a good yellow dye is prepared, while the juice of the ripe berries mixed with alum is the sap green of the painters.

PAPILIONACEÆ (Six Species, belonging to Four Genera).

11. The Common Furze, Gorse, or Whin (*Ulex europæus*).—This, perhaps our commonest native plant, is ever an object of admiration to the lover of simple beauty; and we can hardly wonder at Linnæus prostrating himself in a transport of admiration on first beholding its brilliant and widely extended exuberance. Dillenius, too, looked upon our heath-lands, covered with its profusion of golden flowers, and said that he could not find words to express the pleasure which the sight of this plant had given him. It is an evergreen from 2 ft. or 3 ft. to frequently as much as 6 ft. in height, with numerous intricate branches ending in stout thorns. The wood is very hard, of a deep yellow colour, but never attains to a size available for the use of the carpenter, although in the manufacture of walking-sticks it is not unfrequently employed. Where the plant grows unusually luxuriant the stems are, in some parts of Wales, cut for fuel; while in the south of England they are bound in faggots for oven-heating, a purpose for which the wood is especially adapted, as it burns rapidly and with a great degree of heat. As food for cows, horses, and sheep, the gorse when chopped and bruised is considered to be highly nutritious, and is cultivated for this purpose in various parts of the country.

When properly managed it makes a useful hedge or fence, but requires frequent cutting to prevent it becoming naked at the root. On a raised bank, of from 2 ft. to 3 ft. in height, the seeds should be sown in March, after which, for two years, they will require no attention; but during the third and following seasons, an annual summer pruning will alone prevent the furze from getting bare at the bottom, or wearing that dead, unsightly appearance that is so characteristic of it under neglect.

12. The Dwarf Furze (*U. e. nanus*).—As the name denotes, this is a small growing shrub, less hairy, and of a deeper green than the common furze, of which, indeed, it is by some botanists considered as a mere variety, although the luxuriant and more upright growth of the latter is strongly contrasted by the stunted, dwarfish appearance of the plant in question. It is by no means so frequently met with as the common form, although in certain districts it is tolerably abundant, covering tracts of the mountain sides in various parts of England and Wales. The common Welsh form is, however, recognised as distinct from the typical dwarf plant, and is known under the name of *Galli*. It is usually less procumbent than *nanus*,

and with the calys slightly longer. As an ornamental plant for covering dry, sandy banks, the dwarf furze is invaluable, not only for its compact, evergreen appearance, but for its profusion of bloom; for certainly amongst autumn flowering plants it is by far the brightest.

13. The Dyer's Greenweed (*Genista tinctoria*).—A spineless shrub, from 1 ft. to nearly 2 ft. in height, with branching, decumbent stems, the flowering ones alone being erect, and a profusion of yellow flowers arranged in a rather short raceme. It is of frequent occurrence in neglected pastures, along the borders of cornfields, and in waste uncultivated ground generally. A yellow dye is prepared from the plant that has been found valuable in staining woollen fabrics.

14. The Petty Whin (*G. anglica*).—This is nearly allied to the latter, but it is never so tall as that species, and with smaller and paler flowers. The older branches are usually beset with slender, sharp thorns of from one-fourth to one-half inch in length. It is a native of heaths, and affects marshy ground, spongy moors, and damp, rushy pastures throughout England generally.

15. The Common Broom (*Cytisus scoparius*).—This is a common plant throughout Britain, varying from 2 ft. to over 6 ft. in height, according to soil and situation. It inhabits dry, hilly wastes, and where, during the early summer months, its myriads of golden flowers are both lovely and attractive. The wood of large plants has been used for veneering; but it so seldom attains a size sufficiently large for this purpose that its adoption is but rarely attended to, although the quality and graining of the wood renders it of great value for that important purpose. It is said that the house of Plantagenet derived its name from this flower, and various traditions record the circumstance. During the "uncivill civill warres" of the fourteenth century, a sprig of this *Planta Genista* was worn by Geoffrey, Duke of Anjou, father of Henry II., from which cognisance he acquired the name of Plantagenet, and bequeathed it to his descendants. The historical fact is contained in an interesting work entitled the "Wild Garland."

16. The Restharrow (*Ononis arvensis*).—This is a low, much-spreading under-shrub, usually erect, and from 6 in. to over 1 ft. in height, although in this respect it is remarkably variable. It is an occupant of barren, uncultivated ground, hedge banks, and earthen fences, and is remarkably troublesome to eradicate from fields where it once gains a footing. The flowers are of a beautiful rose colour

streaked with a deeper shade, and renders the plant a by-no-means uninteresting occupant of our wild gardens.

ROSACEÆ (Sixteen Species, belonging to Six Genera).

17. The Blackthorn, or Sloe (*Prunus spinosa*).—This—a well-known occupant of neglected ground—is a spiny shrub of from 6 ft. to 10 ft. in height, with finely-toothed, ovate leaves and small white flowers, which appear in early spring and while the plant is still destitute of foliage. From the numerous remains of old hedges throughout the country it is pretty evident that the blackthorn was at one time largely used in their formation; but it has now almost fallen into disuse, being greatly inferior to its near relative, the hawthorn. In the formation of game coverts it is, however, of some value, being well adapted for planting in exposed situations; and as it is of free growth, and sends up numerous suckers, it soon spreads to a great extent.

18. The Wild Cherry or Gean (*Prunus Cerasus*).—Although when in a wild state frequently attaining but shrub size, yet, when grown under favourable conditions, it may well be included amongst our forest trees. As an ornamental as well as valuable timber tree, the wild cherry is but too little known, at least in this country. Many points in favour of it might be adduced—such as immunity from disease, rapidity of growth when planted in suitable soil, and last, but by no means least, value of the timber obtained. For its ornamental qualities, the wild cherry is also valuable, as during early summer, when laden with its pure white flowers, or again in the autumn, when myriads of the shining black fruit hang in clusters from its branches, it will be readily admitted that few woodland trees have a more lovely or conspicuous appearance. In the woodlands of this county I have measured specimens of fully 70 ft. in height, with stems girthing 6½ feet at a yard from the ground. The timber is of excellent quality, and remarkable for the large size of its medullary processes, which give the longitudinal section a bright, satiny lustre, and renders it well suited for ornamental cabinet-work.

19. The Bird Cherry (*Cerasus Padus*).—Nearly allied to the gean is the bird cherry, which occurs rather plentifully in various parts of Britain, notably the north of Scotland. It is a very ornamental tree, rather more leafy than the gean, and produces a valuable timber much sought after by cabinetmakers on the Con-

tinent. The bird cherry is, in this county, comparatively speaking, a rare tree, and in most cases only attains shrub height. One very fine specimen, growing alongside a mountain rivulet and at a considerable elevation above sea-level, is about 40 ft. in height, with a stem girthing 4 ft. 3 in. at a yard up.

20. The Raspberry (*Rubus Idæus*).

21. The Blackberry (*R. fruticosus*).

22. The Stone Rubus (*R. saxatilis*).—The first two species are here, as in most parts of Britain, perhaps too abundant; whereas the latter is a rare plant, inhabiting one or two rocky stations along the sea coast near Bangor. For the production of fruit all three species are valuable, while as natural game covert in open woodlands the first two, more particularly the bramble, have special recommendations, and are preferred by most sportsmen to that artificially formed.

23. The Burnet Rose (*Rosa spinosissima*).

24. The Downy Rose (*R. villosa*).

25. The Sweetbrier (*R. rubiginosa*).

26. The Dog Rose (*R. canina*).

27. The Field Rose (*R. arvensis*).—These five species of rose are all fairly abundant throughout the county generally, while one or two well-marked varieties, notably *R. Wilsonii*, are occasionally to be met with.

28. The Pear Tree (*Pyrus communis*).

29. The Crab Apple Tree (*Pyrus Malus*).—Both these species, more particularly the latter, are evenly distributed throughout the county, but usually as small spreading trees or mere bushes, and seldom attaining cultivated height.

30. The White Beam Tree (*P. aria*).—On the limestone cliffs of the Great Orme's Head, and growing, one would suppose, without a particle of soil, this plant may be seen in its wildest luxuriance. Under cultivation it usually attains to 20 ft. or 30 ft. in height, with a well-branched somewhat rounded head, and is valuable either as a standard in the park or for planting along the outskirts of plantations that are visible from drives and roads. In foliage it is remarkably variable, that in the usually cultivated form being obovate, lobed, and toothed, with a dense flocculent down on the under surface, this latter from its white colour giving to the tree a distinct and peculiar appearance when agitated by the wind. The form that is usually found wild in this county is known by botanists as *P. rupicola*.

31. The Cut-leaved Pyrus (*P. torminalis*).—This is usually found wild as a large spreading shrub, with broad, deeply divided leaves, these being covered with a loose down, which gradually disappears as the season advances. The flowers are smaller and usually more numerous than in the last species, and with globose or pear-shaped brown fruit.

32. The Rowan Tree or Mountain Ash (*P. aucuparia*).—A well-known and elegant native tree that is at once distinguished from the preceding species by the regularly pinnate leaves. The scarlet berries of this tree, which are usually borne in great abundance, render it highly attractive and ornamental during the autumn months. In this county it ascends to a considerable height on the Snowdon range, growing from the clefts of the rocks, and braving fearlessly the wildest blasts of that wild and romantic situation.

33. The Hawthorn (*Cratægus Oxyacantha*).—This common native shrub or small tree requires no description, for who is there that is not well acquainted with the pure white or pinky flowers of the May? Apart altogether, however, from its ornamental qualities, the hawthorn is, perhaps, our most useful native shrub, for certainly, taking circumstances into consideration, no other plant can equal it in the formation of hedges, and for which purpose it is now generally adopted. As an ornamental and thoroughly hardy subject it is one of the best, and when studded over a park or lawn imparts during the spring and summer months a beauty of both foliage and flower that is not readily surpassed.

34. The Common Cotoneaster (*Cotoneaster vulgaris*). –This is a rare native shrub, having but one British station—the Great Orme's Head—and there too becoming fast exterminated by the too pressing attention of visitors. At one time, not many years since, it was fairly abundant, growing in patches here and there along the limestone cliffs, of which the headland is composed. In these its native haunts it seldom rises above a few inches in height, the severe saline blasts keeping it low and stunted, unless in a few favoured situations where specimens of over a foot in height may occasionally be found. Several plants that had been transferred from the headland about thirty years ago, and which I saw the other day, had become, through the more genial surroundings of a country garden, nearly 5 ft. in height, a size never attained in its native wilds.

Ribesiaceæ (One Species).

35. The Gooseberry (*Ribes Grossularia*).—A doubtful native that has for several centuries been extensively cultivated as a garden plant for the sake of its fruit. In several parts of this county it has, however, become quite naturalised, and occurs frequently in open woods and thickets.

Araliaceæ (One Species).

36. The Common Ivy (*Hedera Helix*).—A common occupant of our woods and hedges, regarding the nature and appearance of which it would be superfluous for us to speak. When seen growing on an old wall or ruin, and draping it in the brightest of green, or mantling some woodland tree where its shining foliage is shown off to perfection, we are, perhaps, too apt, in the love of beauty, to overlook its pernicious qualities as an occupant of our woods and plantations. The mild, maritime situation of this county, combined with the dry, rocky soil, is remarkably favourable to the growth of ivy; indeed on most estates, more particularly along the coast, the woodlands are simply carpeted with the plant, and necessitates a considerable annual expenditure of both time and money to keep it within bounds.

Loranthaceæ (One Species).

37. The Common Mistletoe (*Viscum album*).—This parasite is abundant in England, but rare both in Scotland and Ireland. It is an evergreen bush, from 2 ft. to sometimes as much as 5 ft. in diameter, with dichotomous shoots and pairs of light green, entire, fleshy leaves. The flowers are small, greenish yellow, unisexual, appearing usually about April or May. The berries, which are succulent, seeded, and celled, resemble tiny pearls, and are borne in great abundance during winter. There are sixteen oaks upon which the mistletoe is said to be growing in England. In this county the mistletoe is rarely met with in a really wild state, although it is naturalised in the rectory garden at Aber, and in the woods at Gwydyr Castle.

Cornaceæ (One Species).

38. The Cornel or Dogwood (*Cornus sanguinea*).—A rare plant, but not unfrequently met with in a wild state in the woods and

thickets of Carnarvonshire. It rarely exceeds 5 ft. or 6 ft. in height, with red bark, ovate opposite leaves, and terminal cymes of white flowers, which are succeeded by small black berries.

CAPRIFOLIACEÆ (Four Species, belonging to Three Genera).

39. The Common Elder (*Sambucus nigra*).—Although, when under cultivation, the elder attains to the size of a small tree, still, when met with in a wild state, as it commonly is in this county, it rarely exceeds 5 ft. or 6 ft. in height, and is far more inclined to assume a shrubby procumbent habit than to form a straight, upright stem. The Danewort (*S. Ebulus*) is also common in at least one station of which I am aware. The mountainous, uninhabited district in which it occurs entirely precludes the possibility of its having been introduced. For seaside situations the common elder is almost invaluable, and thrives well even in the very teeth of the blast, while in the formation of game coverts it is a valuable adjunct if properly managed.

40. The Guelder Rose (*Viburnum Opulus*).—In hedgerows and thickets this pretty shrub is occasionally to be met with, and where during early summer its small white cymes of flowers are usually borne in rich profusion. Usually it does not exceed 3 ft. or 4 ft. in height, with variously lobed or deeply-toothed leaves, and is glabrous in all its parts.

41. The Common Honeysuckle (*Lonicera Periclymenum*).

42. The Fly Honeysuckle (*L. Xylosteum*).—Both these species are ornamental plants—the former as a straggling climber, and the latter a much-branched shrub of 4 ft. or 5 ft. in height, and usually downy in all its parts. The woodbine, or honeysuckle, not unfrequently climbs to a height of 20 ft., with stems of 3 in. in diameter, and is surpassed by few native shrubs either in the profusion or fragrance of its flowers. In the fly honeysuckle will be found a shrub of very different habit to the latter, with small ovate or obovate leaves, and small flowers in axillary pairs ; these being succeeded by bright scarlet berries, which give to the plant during autumn a by-no-means unornamental appearance. It is rare in this county, although in one or two woods I have found it in considerable quantity.

ERICACEÆ (Six Species, belonging to Two Genera).

43. The Bilberry (*Vaccinium Myrtillus*).

44. The Cowberry (*V. Vitis-idæa*).

45. The Cranberry (*V. Oxycoccos*).—These three species of *Vaccinium* are plentifully distributed throughout the county, but usually at high elevations, although the latter is a frequent occupant of marshy ground near sea-level.

For its delicious fruit the Bilberry is justly prized, which may be also said of the Cowberry and Cranberry; while as ornamental rock or border plants the two latter are well worthy of attention.

46. The Common Heath (*Erica vulgaris*).

47. The Scottish Heath (*E. cinerea*).

48. The Cross-leaved Heath (*E. Tetralix*).—Of the three heaths just enumerated, two at least have a wide range in Carnarvonshire, not unfrequently covering wide tracts of mountain and moor. As ornamental plants all the members of this family are commonly cultivated; while in the manufacture of brooms, and as covert on exposed ground, they are invaluable.

OLEACEÆ (Two Species, belonging to Two Genera).

49. The Common Ash (*Fraxinus excelsior*).—Both as an ornamental and valuable timber-producing tree, the ash is well known to most people. In landscape decoration it is very valuable, the lightness and airiness of its whole appearance—but more particularly when swaying gracefully to the breeze—being a peculiarity that, amongst our forest trees, is, perhaps, quite its own. The valuable qualities of the timber of the ash consist in its great toughness and elasticity, these rendering it well adapted for the construction of agricultural implements, for furniture generally, and in the making of carts, carriages, and waggons—in fact, for any purpose where elasticity and strength is an object. For planting in exposed situations, the ash is likewise of great value, which is still further enhanced by its growing well in soils of very opposite qualities.

Although one of our commonest hedgerow trees, still the ash is ill adapted for such a purpose, the numerous rootlets which run close to the surface and ramify to a wide extent being highly injurious to crops in their immediate vicinity, while the drip from the tree is also more or less deleterious to vegetation beneath its shade.

50. The Common Privet (*Ligustrum vulgare*).—A useful native shrub that attains a height of from 6 ft. to 8 ft., with linear-lanceolate leaves and terminal panicles of small white and deliciously fragrant flowers, which are succeeded by black globular berries. As an under shrub for planting beneath the shade and drip of our larger woodland trees the privet is almost invaluable, and is for

this reason preferred to most other plants for the forming of game coverts, its strong, robust nature and ease of culture being additional recommendations. It bears trimming and pruning well, while for layering where extension of covert is desirable, it has few equals. For hedge forming it has some valuable properties when mixed with the hawthorn, but is of too loose and straggling a nature for planting alone, unless it be as an ornamental fence in favoured situations.

Apocynaceæ (Two Species).

51. The Larger Periwinkle (*Vinca major*).

52. The Lesser Periwinkle (*V. minor*).—These are dwarf, creeping undershrubs, with ovate or oblong leaves, and bright, showy blue flowers appearing in the spring. Both species are valuable for carpeting the taller growing shrubs, and as they thrive well in the shade are not unfrequently used for that purpose. For bordering the sides of woodland walks they have no equal, and when allowed to run unrestrained soon cover a considerable surface of ground with their bright evergreen foliage, which seldom rises more than a few inches from the soil.

Solanaceæ (One Species).

53. The Bittersweet or Nightshade (*Solanum Dulcamara*).—This is a rather rare native, but occurring in a truly wild state in several parts of the county, notably near the entrance to the Menai Strait, and on various parts of the Penrhyn estate, most frequently along the coast. It is of trailing or climbing habit, having long, flexuous stems, which run amongst the branches of other shrubs for support, ovate-cordate leaves, and clusters of purple flowers with conspicuous yellow anthers. The flowers are succeeded by scarlet berries, these being an interesting feature of the plant during the autumn months.

Thymeleaceæ (Two Species).

54. The Mezereon (*Daphne Mezereum*).

55. The Spurge Laurel (*D. Laureola*).—These are small-growing shrubs, the former about 3 ft. in height and deciduous, while the latter, under favourable circumstances, attains to 4 ft. or 5 ft., and is evergreen. Unless in the extreme south of England neither is considered truly wild, although in the copses and thickets of this

county both have become quite naturalised, and are, in some cases at least, reproduced plentifully from seed. The flowers of the mezereon are particularly ornamental during early spring, and are produced before the leaf.

Empetraceæ (One Species).

56. The Crowberry (*Empetrum nigrum*).—On the Snowdon Range this pretty and distinct plant is tolerably abundant, and grows in similar situations to the heath, and also occurs, although in limited quantity, in one or two mountain woods at altitudes of not less than 700 to 800 ft. The berries, which are about the size of a pea and black, are collected by the Welsh children, and sold in the neighbouring towns for the making of jam and tarts. As a garden plant for boggy situations the crowberry is in request, the dwarf, evergreen habit rendering it well adapted for rockwork embellishment.

Ulmaceæ (One Species).

57. The Wych or Scots Elm (*Ulmus montana*).—A large indigenous tree, with spreading branches and broadly ovate, nearly sessile leaves. This tree is generally shorter in the trunk, but often equal in diameter to the English elm (*U. campestris*). The leaves are larger and longer, the shoots stronger, the back thinner and smoother, and the wood lighter in colour and of superior quality to that species generally. It thrives in a great variety of soils and situations, and is equally at home on thin, rocky soil or the best quality of loam. The timber is highly valued by the cabinetmaker, shipbuilder, cartwright, and millwright, while in the manufacture of minor articles it is also largely employed.

Amentaceæ (Twenty-two Species, belonging to Nine Genera).

58. The Sweet Gale (*Myrica Gale*).—Various names have been applied to this plant, such as the bog myrtle, sweet gale, or sweet willow. It is an occupant of moors and boggy places generally, rises from 2 ft. to 4 ft. in height, with deciduous, linear-lanceolate leaves, usually downy underneath. When bruised the leaves emit a pleasant fragrance.

59. The Common Alder (*Alnus glutinosus*).—This, the only native species, is usually when in a wild state, as it commonly is

in various parts of this county, a shrub or small tree, though when cultivated under suitable conditions it occasionally attains a height of from 50 ft. to 70 ft. Damp, wet ground by the margins of streams and rivers are its favourite haunts, and where as a timber tree it reaches its greatest height and is most profitably cultivated. As an ornamental tree the alder has not much to boast of, its dark hue and peculiar mode of growth being averse to taste generally. The wood is much in request for clog-making, and may be considered as of about third rate quality.

60. The Common Birch (*Betula alba*).—This tree, justly styled the "Queen of the Forest," is of remarkably graceful appearance, with slender, weeping branches and silvery white bark. It usually attains a height of 50 ft., with a trunk of 18 in. in diameter, and with the spread of branches small in proportion to the tree's height. The wood is, in value, about equal to that of the alder, and used for somewhat similar purposes, although it is capable of being still further utilised, more particularly in the manufacture of household furniture and utensils. In deep, rich soils the birch attains to greatest perfection, although as regards choice of soil it is far from particular, thriving well in that of a sandy, rocky, or even clayey texture, and at high altitudes.

61. The Common Hazel (*Corylus Avellana*).—Usually the hazel does not exceed 12 ft. or 15 ft., with numerous suckers set around the stem, yet in favourable situations it rises to double that height, and produces a valuable timber for the cabinetmaker. Hazel rods or suckers are much in demand for basket and crate making, ornamental rustic work, whip handles, etc.; while tied into faggots they are considered superior to most woods for oven heating. Moist, rich loam is the favourite soil of the hazel, but it grows well on chalk, gravel, or clay.

62. The Common Beech (*Fagus sylvatica*).—Few of our native trees are more beautiful than the beech, and whether planted singly on the lawn or mixed up with other trees for variety and contrast, it is at all times a pleasing object, and well worthy of attention in ornamental planting or where landscape effect is taken into consideration. In favourable situations it attains a height of 80 ft., with a trunk 2 ft. or 3 ft. in diameter, and produces a valuable wood useful for making flood gates, sluices, mill wheels, and cogs; while as firewood it is considered superior to any other. The beech makes a useful hedge either alone or planted with the thorn, and when kept closely trimmed it affords a great amount

of shelter during the winter and spring months by the persistent nature of its foliage.

63. The British Oak (*Quercus Robur*).—This, the most majestic of our indigenous trees, is no less valuable as a timber producer, for it is well known that the wood is possessed of a greater number of good qualities in conjunction than that of any other tree. In shipbuilding especially its strength and elasticity are applied to most advantage, whilst almost all arts and manufactures are indebted to it. Two extreme forms, but with intermediate connecting varieties, are not uncommon, one, *Q. Robur pedunculata*, having sessile or shortly stalked leaves and pedunculate acorns; while the other, *Q. Robur sessiliflora*, has petiolate leaves, and nearly or quite sessile acorns. This latter form is most abundant in Wales, and from many years' careful observation I am inclined to think from its constant character generally that it is the truly indigenous tree in the counties of Anglesey and Carnarvon. In several of the old natural Welsh forests, or remains thereof, this is the prevailing form, while trees of seedling origin on hill sides and in fields are of similar character and habit.

64. The Bay Willow (*Salix pentandra*).

65. The Crack Willow (*S. fragilis*).

66. The White Willow (*S. alba*).

67. The Osier Willow (*S. viminalis*).

68. The Goat Willow (*S. caprea*).

69. The Round-eared Willow (*S. aurita*).

70. The Creeping Willow (*S. repens*).

71. The Dwarf Willow (*S. herbacea*).—These eight species of willow, with one variety (*S. aurita minor*), are fairly abundant in most parts of the county, the first six, excepting the osier, as timber trees, and the remainder as shrubs that either attain to a few feet in height or creep along the surface, and rarely rise more than a few inches therefrom. The bay willow is a distinct and handsome species, from 12 ft. to 20 ft. in height, with broader, thicker, and more shining foliage than any of the others. It is, moreover, the latest in bloom, producing its bright yellow catkins after the appearance of the leaves. The white and crack willows attain large dimensions, the former having its leaves clothed with silky white hairs when young, thus giving to the foliage an ash-grey appearance; while that of the latter is green and usually glabrous. The common sallow is an extremely variable species, and the commonest of the genus. It is of bush size, with silky,

reticulated leaves, and blooms earlier than any other native species, the short, silky catkins being produced before the leaves. In the dwarf and creeping willows will be found low-growing, straggling shrubs, from a few inches in height to seldom over a foot, the former being known as our smallest native shrub. It is tolerably abundant on the mountain heaths of Carnarvonshire after an altitude of about 500 ft. has been reached, indeed in some favourable districts the ground is almost carpeted with its half-underground stems and twigs.

72. The White Poplar (*Populus alba*).

73. The Aspen Poplar (*P. tremula*).

74. The Black Poplar (*P. nigra*).—The first two species occur in a truly wild state throughout the county generally, but the latter, although naturalised in many out-of-the-way places, can, perhaps, hardly be considered as indigenous. The white poplar is a handsome, fast-growing tree, with ovate-cordate leaves, which are thickly covered with a cottony down on the lower surface, thus imparting to the tree a distinct and ornamental appearance when agitated by the wind. For producing effect on the margins of lakes and ponds this tree is particularly valuable; while as a standard on the lawn and park it has, for diversity of appearance, few equals. The black and aspen poplars, the former in particular, are large, fast-growing trees, and of but little value as timber producers, or rather the quality of timber produced is not such as to cause its being much in demand. For bottoming carts, flooring, and in the manufacture of toys the latter class of poplar wood is, however, still in use. A damp soil, but not surcharged with stagnant moisture, is that in which poplars thrive best.

Coniferæ (Four Species, belonging to Three Genera).

75. The Scots Pine (*Pinus Sylvestris*).—Except the yew and juniper this is the only member of the pine family that is a native of Britain, and there only truly wild in some of the northern Scottish counties. Whether as regards its hardy nature, growing in severe northern climes, and in soils ungenial to almost every other kind of tree, or to its value in the production of useful timber, the Scotch pine must rank high amongst our forest trees. It is also one of the most beautiful and picturesque of trees, with an erect stem of from 60 ft. to 100 ft. in height, covered with brown or coppery bark. On many of the Carnarvonshire hills it

has become quite naturalised, single specimens or groups of two or three being often met with even at considerable elevations, but rarely attaining a greater height than from about 10 ft. to 20 ft. Unfortunately, the Scots pine found in woods throughout the county, generally, is of the inferior type, few specimens of the Highland variety—if variety we can call it—being found, and the timber produced by these trees is comparatively worthless and almost unsaleable.

76. The Common Juniper (*Juniperus communis*).—This is a variable shrub as regards height. On the Snowdon range it rarely exceeds 4 ft. or 5 ft., while under cultivation and in suitable soils specimens may frequently be seen rising to a height of 20 ft., with well-branched stems and of picturesque appearance. On the hill sides here it is usually a dwarf trailing shrub of rather irregular outline, and of a by-no-means ornamental aspect, although occasionally in some of the sheltered gorges and valleys, fair-sized and well-shaped bushes are to be met with. The berries are used in medicine and for flavouring gin, while the oil of juniper is valuable in the preparation of varnish, and the branches and spray for smoking hams.

77. The Dwarf Juniper (*J. nana*).—On the mountain side above Ogwen Lake in this county I have found the dwarf juniper pretty abundant, forming dense cushions of foliage that rarely rises more than 2 in. or 3 in. from the ground. In these its native haunts it usually grows amongst detached rocky *débris* that has got mingled with soil, or even in the open ground in company with such plants as the crowberry, bilberry, and heath. Some botanists consider this but a variety of *J. communis*, but could such individuals see both forms growing in company at high altitudes on the Snowdon range, their doubts would be at once removed, and I have little doubt but that they would join rank with those who consider them as well-defined and distinct species. The dwarf habit is retained under the best method of cultivation, several experiments having been made in this district to ascertain, if possible, whether or not the plant is affected by altitude and situation.

78. The Common Yew (*Taxus baccata*).—This tree is remarkable for its slow growth, great longevity, and the extreme durability of its wood. It is indigenous in Britain, but was at one time far more plentiful than now, as is proved by the number of logs found embedded in the soil, more particularly in

Ireland. On the Welsh hills it is occasionally found in what may be considered a truly wild state. In such situations it rarely rises to a great height, but usually assumes a low spreading habit, with little or no inclination to form a main stem. As in most other countries, the churchyards in Wales abound with numerous fine examples of this tree. To show the great value which was set upon the yew in the early Ages, the following extract of an ancient Welsh law may be given:—

> "A consecrated yew, its value is a pound.
> A mistletoe branch, threescore pence.
> An oak, sixscore pence.
> Principal branch of an oak, thirty pence.
> A yew tree (not consecrated), fifteen pence.
> A sweet apple, threescore pence.
> A sour apple, thirty pence.
> A thorn tree, sevenpence-halfpenny.
> Every tree after that, fourpence."

The wood of the yew is of a beautiful orange-red or rich brown colour, exceedingly hard and close-grained, and takes a fine polish.

XX. *On the Plantations and Trees on the Estate of Brahan, in the County of Ross.* By Alexander Pitcaithley, Forester, Glentruim, Kingussie.

The estate of Brahan is about eight square miles in extent, nearly one-fourth of which is under wood. The land has mostly a southern exposure, and the soil is generally a good loam.

The oldest trees are in the vicinity of Brahan Castle, these being about two hundred years of age, and are, for the most part, showing signs of decay. The youngest plantations are from five to fifteen years old, and these have suffered very much from the want of timely attention being paid to thinning and draining. In some places they are much crowded together and drawn up into spindly poles; while in the hollows they have died off, or barely survive, from the excessive wet. The older plantations are in a fairly thriving state, and consist of hardwoods—oak predominating.

No. 1 contains about 150 acres of Scots fir and larch of from 40 to 50 years' standing; altitude, 400 to 500 feet; soil, clayey till and peat-moss; subsoil, clay and rock; geological formation, conglomerate; exposure, S.W. The Scots fir in this wood have thriven well, but show a good many black knots when cut up. The larch have not done so well, and are very much "blistered." The trees are from 40 to 50 feet in height, and contain each from 10 to 15 cubic feet.

No. 2.—About 500 acres in extent and consists of Scots fir and larch from 10 to 15 years of age; altitude, 300 to 350 feet; exposure, W.; soil, peat-moss; subsoil, gravelly clay; geological formation, conglomerate. The trees have thriven well, except in the hollows, where the neglect of having proper drainage has injured them and retarded their growth. The Scots fir range from 9 to 18 feet and the larch from 12 to 20 feet high.

No. 3 consists of 130 acres of Scots fir and larch from 5 to 10 years of age; altitude, 250 to 300 feet; exposure, W. and N; soil, peat-moss; subsoil, clay. The plants are from 5 to 12 feet in height, growing on ground that had previously yielded a heavy crop of Scots fir, notwithstanding which they are thriving well, though the larches in some places are suffering from want of proper drainage, and some parts are also very much in need of thinning.

No. 4 is a plantation of 700 acres of hardwoods, principally oak, with a few larch, spruce, and Scots firs, from 40 to 100 years of age; altitude, 150 to 300 feet; exposure, S.; soil, light loam; subsoil, gravelly clay; geological formation, conglomerate and sandstone. The trees are from 50 to 70 feet high, with a circum-

ference of from 8 to 10 feet at 5 feet from the ground, and containing from 20 to 30 cubic feet. The clump of larch mentioned by Mr Grigor in his "Arboriculture," p. 220, is in this plantation. There are about 30 of these trees still standing, although the largest have yielded to the storms. They are about 100 years of age, and range from 100 to 120 feet in height, containing from 100 to 150 cubic feet of good timber, and are still sound and healthy. They were grown from seed of the larches at Belladrum, Inverness-shire, which are of the same lot as those at Dunkeld and Blair Athole. The Brahan larches are therefore among the first plants raised from home-grown seed.

Beside this clump of old larch there were several trees of the same age planted singly throughout this and other plantations on the estate. These have grown equally well, one tree in this same plantation reaching the height of 135 feet. Besides the larch there is also a clump of Norway spruces, 100 years of age, 110 feet in height, and containing each about 130 cubic feet. There are also several large beeches and Spanish chestnuts, about 75 feet high, with a girth of from 10 to 12 feet in circumference at 5 feet up. The whole of this plantation is in a healthy state.

No. 5 comprises 200 acres of hardwoods; altitude, 100 to 200 feet; exposure, E. and W.; soil, light loam; subsoil, gravel; geological formation, sandstone. The largest part of this plantation is oak, with a mixture of beech, ash, natural birch, and alder, and a few spruces. The oaks are from 40 to 50 feet in height, with a circumference of 3 to 5 feet, and contain from 10 to 15 cubic feet each.

There are also two clumps of Scots fir, 25 and 35 years old. The youngest has thriven well, and the trees are from 30 to 35 feet high, but being grown rather close, their girth is not proportionate to their height.

The second clump is growing on land which had previously yielded a crop of Scots fir, and the soil being poor and light, the trees have consequently not done so well. They are from 30 to 40 feet high, and from 2 to 3 feet in circumference. These clumps, as indeed all the Scots fir and larch on the estate, have suffered severely from the ravages of squirrels, which are very numerous, and do great damage every year during the months of May and June, by barking the stems of the trees.

No. 6 is another plantation of 350 acres of hardwoods; comprising oak, ash, beech, Spanish chestnut, Scots fir, and birch; altitude, 150 to 200 feet; exposure, S. and W.; soil, good loam; subsoil, gravelly clay; geological formation, conglomerate and

sandstone. The largest part of this plantation consists of oak, from 40 to 50 feet in height, which are growing on ground that has yielded a crop of larch. The whole of the plantation is in a very healthy and thriving state, with the exception of the ash, which has been planted in the bogs and damp places, the timely and proper drainage of which has not been attended to. The trees, in consequence, have made little progress, and are black in the heart when they are cut up. They only average from 18 inches to 2 feet in circumference, and contain from 5 to 8 cubic feet, while most of the oak will measure double that size.

In this plantation are two clumps of the newer conifers. In the first one, which contains about twenty plants, those that have done best are a *Picea Nordmanniana*, 43 feet in height, girthing 5 feet 8 inches at 3 feet up, and clothed with branches to the ground, the spread of branches being 35 feet; a *Picea pinsapo* is 25 feet in height, and a very symmetrical tree; an *Abies Douglasii* is 50 feet high; a *Cupressus Lawsoniana*, 23 feet high. Of *Thuja gigantea* there is a very healthy and flourishing tree, 45 feet high, and 4 feet 9 inches in circumference at 3 feet from the ground; a *Cryptomeria Lobbi* is 20 feet in height; a *Cedrus deodara* is 38 feet high. There are also some very healthy specimens of *Cupressus Nutkaënsis*, *Wellingtonia gigantea*, *Pinus excelsa*, *Araucaria imbricata*, and others. They are growing in good loamy soil, with a southern exposure, and are sheltered on the north and east sides by a Scots fir plantation. They are from 20 to 25 years of age, and grow at an altitude of about 120 feet.

The second clump, which contains about 40 trees, is at an altitude of 200 feet, on a light loamy soil, resting on gravel, and with an open exposure. The trees here have been planted by friends of the Seaforth family at various times, chiefly between the years 1863 and 1866. Two *Wellingtonias* are now 48 and 40 feet in height, respectively, the latter being 7 feet 9 inches in circumference at 3 feet up, with a spread of branches of 28 feet. Two *Picea nobilis* are 46 and 36 feet high—the former being a very handsome specimen girthing 5 feet 1 inch at one foot, 4 feet 5 inches at 3 feet, and 4 feet 3 inches at 5 feet from the ground; spread of branches, 27 feet. A *Picea Parsonii* is 36 feet high, girthing 6 feet 4 inches, 5 feet 10½ inches, and 5 feet 4 inches, at 1, 3, and 5 feet up. *Pinus excelsa* is 23 feet in height; *Pinus cembra*, 25 feet; *Pinus Craigiana*, 31 feet; *Abies Douglasii*, 42 feet; *Abies Albertiana*, 31 feet; *Abies Smithiana* or *Morinda*, 20 feet;

Cupressus Lawsoniana, 24 feet; *Cupressus Nutkaënsis*, 26 feet; *Araucaria imbricata*, 20 feet; *Libocedrus decurrens*, 18 feet; *Cedrus deodara*, 27 feet; *Picea grandis* and *Picea Nordmanniana*, each 20 feet in height.

No. 7 contains about 60 acres, and consists of several belts or strips on Brahan home-farm, planted chiefly with oaks; altitude, 150 to 250 feet; soil, light loam; subsoil, clay; exposure, S.; about 40 years of age. The trees range from 30 to 50 feet in height; and contain each from 7 to 12 cubic feet of timber.

There are also several good lines of trees in the hedge-rows; the best being alongside the east and west approaches. These last consist entirely of oak, about 70 years of age and 60 feet in height; the average cubic contents of each being 25 feet. There is also a single row of oaks alongside the Turnpike road, of the same age and size; and a fine avenue of old sycamores and ashes, north and south of the castle. These latter are about 200 years of age, and show signs of decay. The sycamores are 80 feet high, and are from 8 to 12 feet in circumference at 5 feet up. A little to the east of the castle is a fine clump of limes, about 150 years of age; height, 80 to 90 feet; girthing from 10 to 12 feet 6 inches at 3 feet up. The soil is a good loam; exposure, S.; altitude, 200 feet. About 300 yards east of the Castle is "The Dell," a piece of ground laid out with walks, and planted with Rhododendrons, Azaleas, Kalmias, and such-like. The collection of Rhododendrons is one of the most comprehensive in the country. There is also here a circle of beeches,—40 in number, of about 200 years of age, 90 feet in height, and several of them over 12 feet in circumference at 3 feet up; a beautiful *Abies Douglasii*, 78 feet high; a Cedar of Lebanon, 65 feet; an English elm, 60 feet; and a purple beech, 70 feet in height. At the river-side, a little to the south of the Dell, is a clump of very large Scots firs, 200 years of age, and 72 feet in height, with a circumference of 12 feet at 5 feet from the ground. The soil is a sandy loam; subsoil, gravel; and the exposure is south. The tree of greatest girth on the estate is an ash growing in the field about 200 yards west from these Scots firs, which girths 16 feet at 5 feet up. It is now past its best and decaying. The tree of greatest cubic contents is a sycamore, west of the castle, with a clean bole of 30 feet, with very little taper, containing 320 cubic feet, and apparently sound.

Subjoined is a tabulated list of the largest trees on the estate, with their measurements, and where they are growing.

No. of Tree.	Common Names.	Botanical Names.	Altitude.	Soil.	Subsoil.	Exposure.	Height of Tree.	Length of Bole.	Circumference of Trunk.						Diam. of Spread of Branches.	Age.	Cubic Contents.	Where Growing.
									1 ft. up.		3 ft. up.		5 ft. up.					
			Ft.				Ft.	Ft.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	Yrs.	Ft.	
1	Sycamore,	*Acer pseudo-platanus*,	200	Black loam,	Clay,	S.W.	90	30	15	6	13	0	12	6	63	200	320	100 yards west of Castle.
2	Lime,	*Tilia Europæa*,	200	,,	,,	S. & E.	79	16	16	1	12	0	11	6	77	150	140	150 yards east of Castle.
3	,,	,,	180	,,	,,	S.	70	15	17	4	13	9	13	8	66	180	150	100 yards south of Castle.
4	Beech,	*Fagus sylvatica*,	180	,,	,,	S.W.	76	18	19	0	16	0	13	10	84	200	180	30 yards east of the "Dell."
5	,,	,,	180	,,	,,	S.	85	20	20	0	16	1	13	6	70	200	240	20 yards east of the latter.
6	Purple Beech,	*F. Sylvatica purpurea*,	200	,,	,,	S. & E.	63	17	9	8	8	6	7	10½	62	60	45	North-east corner of Castle.
7	,,	,,	150	Sandy loam,	Sandy clay,	S.W.	70	12	13	8	10	6	10	5	68	100	80	Foot of the "Dell."
8	Wych Elm,	*Ulmus montana*,	180	,,	,,	S.E.	80	13	18	0	15	2	14	0	70	200	160	100 yards west of Castle.
9	,,	,,	150	Loam,	Clay,	Open,	60	15	18	10	16	7	14	1	66	200	115	100 yards south of Castle.
10	English Elm,	*Ulmus campestris*,	150	Sandy loam,	Gravelly clay,	W.	60	15	11	2	10	1	9	10	76	150	95	Foot of the "Dell."
11	Ash,	*Fraxinus excelsior*,	120	,,	,,	Open,	75	18	22	6	19	0	16	0	73	200	180	Field at river side.
12	Oak,	*Quercus pedunculata*,	200	Black loam,	Clay,	S.	80	14	19	8	15	3	14	0	90	200	190	Side of west approach.
13	Turkey Oak,	,, *cerris*,	160	Light loam,	Gravel,	S.W.	70	18	12	9	11	7	11	9	90	80	75	400 yards east of the "Dell."
14	Evergreen Oak,	,, *ilex*,	140	Tilly loam,	,,	S. & W.	54	21	9	0	8	0	7	8	45	60	50	200 yards south of the latter.
15	Black Italian Poplar,	*Populus monilifera*,	220	Black loam,	Clay,	S. & E.	75	23	17	8	15	7	15	5	105	160	196	50 yards west of the steading.
16	Lombardy Poplar,	,, *fastigata*,	180	,,	,,	Open,	105	40	9	5	8	9	8	8	28	80	60	Field in front of the gardens.
17	Spanish Chestnut,	*Castanea vesca*,	280	Light loam,	Rocky till,	S.	63	26	13	0	11	9	11	1	60	120	100	North side of public road.
18	Horse Chestnut,	*Æsculus hippocastanum*,	160	Black loam,	Clay,	S. & W.	55	12	14	0	11	9	11	3	64	150	80	100 yards south of Castle.
19	Larch,	*Larix Europæa*,	280	Tilly loam,	Till,	S.	115	..	13	10	11	10	11	0	..	100	150	North side of public road.
20	Norway Spruce,	*Abies excelsa*,	270	Light loam.	Till,	S.	120	..	14	6	11	4	10	6	..	100	130	,,
21	Douglas Spruce,	,, *Douglasii*,	160	Light loam,	Sandy clay,	E. & W.	78	..	9	6	9	0	8	1	40	43	80	Foot of the "Dell."
22	Noble Silver Fir,	*Picea nobilis*,	180	Loam,	Clay,	S.	50	..	7	3	6	10	6	8	36	35	28	Behind Castle.
23	Scots Fir,	*Pinus sylvestris*,	110	Sandy loam,	Gravel,	S.	72	25	13	9	12	10	12	1	55	200	100	River side.
24	Oriental Plane,	*Platanus orientalis*,	220	Black loam,	Clay,	S.	55	13	11	6	10	6	10	3	60	80	55	80 yards west of steading.
25	Cedar,	*Cedrus Lebani*,	160	Light loam,	Sandy clay,	S.E.	60	30	9	1	8	3	7	10	67	80	60	In the "Dell."
26	,,	,,	220	Black loam,	Clay,	S.	65	10	12	6	11	9	11	7	72	150	86	100 yards west of steading.

XXI. *Specifications of Works to be Executed in the Erection of a Forester's Cottage.* By ALEXANDER PITCAITHLEY, Forester, Glentruim, Kingussie.

(*See Plate XII. for Plans and Sections.*)

MASON WORK.

Mortar to be of fresh burnt lime, and clean fresh-water sand.

Excavations.—The tracks for the foundations to be dug out to the depth shown in the sections, or as much more as may secure a firm foundation.

The foundations will be formed (as shown on drawing) of "deadies" in single stones not less than 6 inches thick.

The next course, over same, will also be in single stones, each the breadth-way laid to break bands, and of lengths not less than 3 feet 6 inches by 6 inches thick, all laid solid in beds of mortar, and the inside scarcements to be carried up to form sleeper walls.

The walls throughout to be built of the best description of masonry. Stones to be laid on their quarry or natural beds.

The walls and gables will be built of "shoddies" neatly dabbed, except back wall, which will be of hammered stones and sneck-pointed. Offices, etc., will be of brick, neatly built and pointed, as shown on plan. Proper raggles to be formed for slater, etc.

All the walls to be beam filled up to roof sarking, and sneck-pointed inside after the straps are put on. Outside of all walls to be pointed with cement. Joints to be drawn level and plumb.

Doorways of front and back door to get sills as shown on plan. Front door sill to be cheeked for pillars of porch. All mullions to be of single stones, and to be neatly chamfered as shown on plan. The vents to get fireclay linings, and cans to be selected, value 8s.

The hearths, all of half-rubbed pavement, to be 4 feet by 2 feet by 2 inches, with back hearths, set on rubble foundations.

The contractor will also supply and fit in registered grates in the parlour and bedrooms, value 12s. 6d. each; but in the kitchen a cooking range, value 50s. Mason will point and bed all windows, doors, etc., with good hair lime.

Any slight omission in this specification must be made good by the mason if clearly seen on the plan.

Rubbish from foundations, etc., must be all cleared away from the job as directed.

Carpenter Work.

All timber for roofing, doors, windows, lintels, and all wood-work, except flooring, will be of Swedish redwood. Flooring will be of Norway white-wood, well seasoned, and cut square to specified sizes. Safe lintels will be $1\frac{1}{4}$ inches thick to a foot of clear carry, but not less than 3 inches at smallest opening.

Roofing.—The roof to be formed as shown. Rafters and ties to be $6\frac{1}{2}$ inches by $2\frac{1}{2}$ inches; and lower end of rafters, which projects over wall, to be dressed. Top side of projecting rafter will receive a "soffer" of $1\frac{1}{8}$ inches lining, sunk flush for sarking to come over.

The gables to receive the necessary cantilevers, and to get a fretted face board $1\frac{1}{4}$ inches thick.

The carpenter will put on the necessary fillets, etc., for the slater and plumber. The roof windows will be formed as shown, with framing of 5 inches by 2 inches, lined on face above window with $\frac{7}{8}$-inch lining in 3-inch breadths; also to receive face boards and rustic work as shown on plan, the ridge to receive grounds and battens $2\frac{5}{8}$ inches by $1\frac{5}{8}$ inches.

The roof will be sarked with $\frac{3}{4}$-inch square-edged sarking. The roof of porch will be formed with rafters 6 inches by 2 inches, and sarking of $1\frac{1}{8}$ inches lining, with bead on edge; and all wood-work exposed inside porch will be dressed. The pillars will be formed as shown on plan, with chamfered edges; beams running above will be 5 inches by 5 inches. The gable will be formed as shown, with projection face boards and rustic work. The paling at the side of the porch will be as shown, with cross spars and cope on top 3 inches by $2\frac{1}{2}$ inches. The roof of back offices will be formed of rafters 5 inches by $2\frac{1}{2}$ inches as shown, and sarked with $\frac{3}{4}$-inch sarking.

Windows.—Windows to be made as shown, in the common sash form, with frames 2 inches thick; top sashes to be hung with axle pulleys, cords, and weights, and to receive sash-fasteners and lifts, and to be glazed with 21-ounce sheet glass, after first being primed.

Doors.—Outside doors, framed 2 inches thick with filleted panels, hung on 6-inch hinges, and to get lock, value 7s. 6d. All the inside doors to be panelled with frames $1\frac{1}{2}$ inches thick, having sunk mouldings, hung on 5-inch edge hinges, and locks, value 5s. 8d., except presses, which will get locks, value 1s. 6d. Back outside door to be framed and clad 2 inches thick, and to get lock and hinges, value 5s. 6d., with frames $5\frac{1}{2}$ inches by $2\frac{1}{2}$ inches.

Joists.—The joists to be 8 inches by 2½ inches, set at 18 inches apart, and covered with 1½-inch mill-wrought flooring; also to be bridled at well-hole for stair. Sleepers to be 6½ inches by 2½ inches, set at 18 inches apart, and covered with 1⅛-inch flooring.

Outside Water-Closet will also get sleepers and flooring as above.

Wall Presses.—Four lined wall presses, sides ⅞ inch, back ⅝ inch, and four tiers of 1⅛-inch shelves, fitted into two ground floor rooms and two upstair rooms as shown. Partitions throughout to have 4-inch by 2-inch standards, prepared for lath and plaster, and to get door frames 2½ inches thick to flush with plaster.

Stair.—Stair to be formed as shown on plan, steps 1¼ inches; stringers, 1¼ inches; and risers ⅞ inch; to get turned pitch pine balusters and hand rail.

Water-Closets.—Two Water-Closets to be framed and fitted up with pitch pine, one in house and other in offices, with hinged lid, and moulded, and panelled front.

Sink.—Sink in scullery will be framed and fitted up with hinged door for access to pipes, with lined front, and hardwood cope 1½ inches thick; also window to get sill lining 1⅛ inches thick to flush with cope of sink; the sink will have a hinged lid on the top, to form a table when shut.

Offices.—Outside offices to get each a door of 1½-inch redwood on three backings, and fastened with latches and stock locks value 5s. each. Both the Water-Closets to have a pane of glass fitted in their doors where directed, 12 inches by 12 inches. Door frames of offices to be 4 inches by 2½ inches, and hung with cross-tail hinges. Three small doors and frames, to be fitted on ashes and coal houses as shown. All outside doors to get stops, with bead on edge, ⅝ inch thick. Inside doors to get stops and facings, with blocks. The parlour and two bedrooms will each receive a plain box pilaster mantelpiece, and the kitchen a shelf on brackets.

Skirting.—All rooms, passages, etc., to get a skirting-board ¾ inch by 6½ inches, with moulding on edge.

Shelving.—Windows to get sill lining, to flush with walls, 1⅛ inches; 60 feet of shelving, 12 inches broad, to be fitted up on wooden brackets where directed. All corners and angles will get corner beads. Closet at stair landing will get three tiers of shelving on each side, 18 inches broad by 1⅛ inches thick. All stone walls to be strapped with straps 1¼ inches by 1½ inches, as will also walls of outside Water-Closet.

Note.—The carpenter will give all outside woodwork two coats of oil paint, tints to be selected; also to varnish and grain "oak" the outside of the door.

Slater Work.

The roofs to be covered with Port Dinorwick slates, 16 inches by 10 inches, put on with a cover of 3 inches, double nailed, and well bonded. All raggles to be pointed with Portland cement.

Plaster Work.

The plasterer will coat and finish in the usual way with good hair lime, all walls, ceilings, and partitions throughout, as also ceiling and walls of outside Water-Closet. Lath, to be supplied and nailed on by plasterer, to be of $\frac{1}{4}$-inch red boards, split up to proper sizes. A 5-inch cornice to be run on the ceiling of the parlour. All beads to be properly relieved. Blisters, cracks, and breakages after other tradesmen to be made good.

Plumber Work.

The lead for all purposes to be soft melted, weighing 6 lbs. per superficial foot for ridges and flanks, and for all other purposes to be 5 lbs. per superficial foot. The ridges to be 13 inches broad, and the valleys 12 inches; skew bottoms and chimney neck flashings to be 10 inches broad; flashings of dormers 9 inches, and soles of dormers 12 inches broad; finial blocks to be covered with lead.

The rones on all eaves to be Macfarlane's No. 4; joints to be bedded in white lead, with the necessary stop-ends and drops to down-pipes, which will be 3 inches in diameter, secured to walls with iron holdfasts. Down-pipes to be set on 6-inch trap grating set in stone, and joined to a tile drain.

The sink in the scullery to be of white enamelled fireclay, 26 inches by 14 inches by 8 inches inside, with brass plug and chain, and $2\frac{1}{2}$-inch soil-pipe, trapped, of 6-lb. lead, with brass cleansing screw. The soil-pipe to be carried 2 feet beyond wall, and carefully joined to a tile drain.

The Water-Closet in the house to be Troyford's white earthenware, set on safe of 4-lb. lead, having the necessary $1\frac{1}{4}$-inch supply pipe, and two-gallon syphon cistern complete. Soil-pipe $4\frac{1}{2}$ inches

in diameter, carried out two feet beyond wall, and joined to a tile drain. A 6-inch glazed spigot and faucet tile pipe will be laid from Water-Closet, as shown by dotted lines, and 4 inches tile pipe from sink and rain-water pipes, all laid with a regular fall, and jointed with Portland cement.

A No. 4 Shank & Son's Water-Closet to be placed in back offices where shown, with a 4½-inch soil-pipe carried out and joined to the tile drain.

Water supply.—A concrete tank to be formed where shown on plan, 3 feet 6 inches, by 2 feet 6 inches, by 2 feet deep. The supply pipe ¾ inch, 10 lbs. per yard patent lead pipe, with ¾-inch screw cock and stand pipe at sink, a stop cock to be placed where shown on pipe. The contract price to include digging and filling-in tracks, and putting on the water to Water-Closets and sink complete.

XXII. *On the Present State and Future Prospects of Arboriculture in Hampshire.* By JOHN SMITH, Surveyor, Romsey, Hampshire.

SITUATION.

Hampshire, with the Isle of Wight, is bounded on the north by Berkshire, on the east by Surrey and Sussex, on the west by Wiltshire and Dorsetshire, and on the south by the British Channel. It is about 55 miles from north to south, and about 36 from east to west; being of an irregular oblong figure, lying between 50 degrees 34 minutes and 51 degrees 22 minutes north latitude, and between 43 minutes and 1 degree 54 minutes west longitude; and has a total area of 1,040,000 acres.

The Isle of Wight is separated from the mainland by the channel called the Solent, which varies in breadth from two to seven miles. The island has an area of 105,000 acres, which is included in the above.

GEOLOGY.

The soils of Hampshire are various, ranging from the rich alluvium of the valleys, the stiff clays and the light soil of the chalk downs, to the poor sandy soil of the Upper Bagshot. A vast deposit of chalk forms the greater proportion of the subsoil, being estimated at 371,200 acres, or about one-third of the whole area. This deposit is divided into two sorts, the middle and upper; the former towards the north and the latter towards the south. The upper chalk is soft, and contains beds and nodules of black flints; the middle is harder and of a darker colour, and the soil generally poorer.

The boundary of the chalk may be described as commencing at the north-west boundary with Berkshire at East Woodhay, proceeding south-east to Street and Highclere, then east to Itchingwells; thence south-east by east to Kingsclere, Ewhurst, Monks Sherbourne, Sherbourne St John, Chinham, Old Basing Greywell, Odiham, to Croudall; thence south-east to the borders of Surrey, where it is only about a mile broad, recommencing at a place called Checksfarm; thence almost due west to Easanage; from thence in a zigzag outline by Lower Froyle, Froyle, and Holybourne to about a mile south-east of Chawton; then a south-easterly direction by Selbourne to Empshot; thence south-

westerly to East Meon; then south-east by east to Buriton to the borders of Sussex. Commencing at Rowland's Castle at said Sussex boundary, it takes a north-westerly direction to Horndean; then in a zigzag line to Bishop's Waltham, Upham, Otterbourne, to the south of Hursley Park; then nearly due west to Timsbury, north to Michelmersh; then west to Mottisfont, north to Pittleworth; then curving south-west by Bently to East and West Tytherley, where it joins the Wiltshire bed south of Norman Court. It thus occupies a large portion of the centre of the county. Within the above boundary are many detached patches of the plastic clay, a rather large deposit of which occurs at Froxfield. At Burghclere and Sidmonton is a deposit of the Upper Greensand. In the valleys of the rivers Test and Itchen, with their tributaries, are considerable deposits of alluvium. Detached from the great central bed of chalk are four others, namely at Deanhill, Rockbourne, and Breamore, which are extensions of the Wiltshire bed. On the south another detached portion occurs, commencing at Emsworth, thence west to Havant, Bedhampton, Boarhunt, to the Titchfield river, returning east by Farcham, Portchester, to West Thorney, taking in the northern parts of Hayling and Thorney Islands. Within this area rises Portsdown Hill, bold and bare, to the height of 450 feet above sea-level, and here stands the monument erected to the memory of Lord Nelson.

The general character of the chalk at present is down and cultivated fields, and is not naturally favourable to the growth of trees, although some writers have ventured the opinion that it was, previous to the Roman invasion, one vast forest. This is not borne out by investigation, for when the chalk is laid bare not a tree root nor the vestige of one can be found. With the exception of the yew not a root cares to penetrate the chalk pure and simple; but many an ancient specimen of the yew is to be found rearing its weather-beaten form, scarred with the blasts of centuries, on the bare and wind-swept chalky downs. The juniper also finds here a congenial home, but where there is sufficient depth of soil above the chalk most of our forest trees will thrive and produce the best of timber, particularly oak and beech; and it may be taken generally that the quality of the timber grown on a chalk subsoil is superior to that of any other in this county. Within the area above described is to be found some of the richest wooded parks in the county, such as Hurstbourne (Lord Portsmouth), Highclere (Lord Carnarvon), Hackwood (Lord Bolton), The Grange (Lord Ashburton), Stratton

(Lord Northbrook), Hursley (the Heathcote Trustees), Norman Court (William Baring, Esq.), and many others, besides the historical forest of Harewood, where King Edgar, in the year 963, at the instigation of Elfrida, the wife of Earl Ethelwold, and a daughter of the Earl of Devon, slew with his own hand the said Earl Ethelwold, that he might obtain Elfrida for his queen. Harewood is one large area of about 700 acres.

The northern part of the county, from the chalk to the boundary with Berks, is occupied by the Woolwich and Reading beds (plastic clay), the London clay, Lower Bagshot, Bracklesham, and the Upper Bagshot beds with alluvium in the valleys, and forms part of the basin of the Thames.

The plastic clay forms a narrow strip skirting the chalk on the north, and consists of dark blue, reddish, and yellow clays, interstratified with sand of various colours, and is favourable to the growth of the oak, and may be called the oak zone.

The London clay comes next, skirting the plastic clay and along the Embourne and Blackwater rivers, dividing the counties of Hants and Berks, being connected by irregular bands from north to south. The mixture of this deposit with the others gives a distinctive character to the woodlands of this part of the county. On this formation is Strathfieldsaye (Duke of Wellington), rich in woodland scenery. Most of our hardwood trees thrive on the London clay.

The Lower Bagshot beds occur in large and small irregular patches. They consist of brown and yellow sands, gravel both sharp and pebbly intermixed with different coloured clays, also poor sandy and peaty soil—a veritable hotch-potch of geology; so that there is every sort of soil suitable for every sort of tree, and what are popularly known as "American plants." A large portion is open heaths, but it has also the large woods of Penwood and Pamber Forest; and the finely wooded parks of Heckfield (Lord Eversley) and Dogmersfield (Sir H. P. St John Mildmay) are mostly on this formation.

The Bracklesham or Middle Bagshot beds are not of large extent, the most considerable patches being at Bramshill and Elvetham Parks, Hazeley Heath, Hartley Wintney, and by Winchfield, and consists of various clays, sand, and gravel, suitable for the growth of most of our trees.

The Upper Bagshot forms the arid soil of Aldershot and the large tract of heath called Hartford Bridge Flats; and although called "flats," they are of considerable elevation above the sur-

rounding country. The deposit extends from Hawley to Eversley Common, and about a mile broad, of irregular shape, being indented with narrow gorges, which give rise to a number of streamlets running to all the points of the compass. At about a mile and a half from the village of Blackwater, on the Berkshire border, and on the great road from London to the south-west, at the thirty-second mile-stone, the "flats" commence; and for a distance of three miles the road is as straight as an arrow and nearly level, passing over about as bleak and barren a piece of heath as is to be found in England, with nothing to relieve the eye but a few clumps of thorns and brambles. Like oases in the desert, these afford some shelter from the bitter blast which otherwise sweeps unchecked across this barren waste. Of late years the Scots fir has made attempts to dispute the sway of barrenness; but hardy as it is, and of a perseverance characteristic of its countrymen, its progress is slow.

On the *east* side of the county adjoining Surrey and Sussex is the Folkestone beds, the Gault and Upper Greensand older formations, and underlying the chalk. The character of the scenery of this part is different—the slopes, locally called hangings, being more abrupt and the outlines bolder than the rounded forms of the chalk hills. The royal forests of Alice Holt and Woolmer are situated here, the former on the Gault and the latter on the Upper Greensand.

The *south-western* part of the county consists of the plastic and London clays, the Lower Bagshot and Bracklesham beds, the Barton clay, Upper Bagshot sand, the Osborne and Headon beds, with alluvium, shingle, and blown sand. The plastic clay skirts the boundary of the chalk from Westbourne in Sussex to West Tytherley on the borders of Wiltshire; it again appears at West Dean, following the chalk of Dean Hill, and entering Wiltshire near Melchet Park; it reappears at Fordingbridge, thence to Whichbury and to West Park, returning to Fordingbridge. It also follows the chalk from Emsworth and across the Titchfield river, on the west side of which there is a large deposit, returning by Portsmouth, Hayling Island, to West Thorney.

The London clay follows the course of the plastic, in a broader and more irregular belt, but is not found detached. On this and the plastic clay is situated the Royal Forest of Bere and the ancient forest of Waltham Chace, belonging to the Bishop of Winchester, but which is now mostly enclosed and cultivated.

The Lower Bagshot commences at Bedhampton Park, midway between the principal chalk formation and that of Portsdown Hill, and extending westward to Wickham in irregular patches, surrounded by the London clay, like islands in the sea. At Wickham it divides into two belts, one following the London clay by Bishopstoke, Romsey, Wellow, and Bramshaw, where it expands into a broad belt at the boundary with Wilts. It then re-enters Hampshire south of Bramshaw Heath, there bounded by the Bracklesham beds on the south, and terminating at Ower near the finely-wooded park of Paultons (Hans Sloane Stanley, Esq.). Going back to Wickham, a narrow belt runs westward, dipping under the Hamble river at Hamwood, to near Botley Common; then curving southward to Bursledown, then south-eastward by Swanwick, Fareham Park, Elson, and Portsea, and terminating at Langston Harbour. A broad belt commences at Bournemouth and Christchurch, thence northwards along the boundary of Dorsetshire to Ringwood, where it is found on both sides of the river Avon as far as Fordingbridge, then running north-eastward across the New Forest it enters Wiltshire at Hatchet Green.

The Bracklesham or Middle Bagshot occupies a large area, commencing at Langston Harbour westward to Portsmouth, Gosport, and Titchfield, to the Hamble river. It then occupies the whole of the area between Southampton Water on the south-west to Romsey on the river Test, curving north-eastward to Ampfield, south-eastward by Chandlers Ford, Bishopstoke Station, to Wickham, on the Titchfield river. A broad belt commences on the west side of Southampton Water, opposite Southampton, going north-west to Tatchbury Mount, where it divides into two, one proceeding up the valley of the Test on the opposite side of the river from the town of Romsey to Shootash Hill; the other belt proceeds to Pollard's Moor and Canterton near Rufus's Stone. It then zigzags in a narrow belt with Wiltshire. It then re-enters Hampshire at Black Bush Plain, crossing the New Forest to Ringwood, where it is to be found on both sides of the Avon river to the sea.

The Barton clay, Upper Bagshot sand, the Osborne and Headon beds, are included in the large tract of land from Wiltshire on the north to the sea and the Solent on the south, and from Southampton Water on the east to the river Avon on the west, and forming the most important subsoils of the New Forest, the

largest in area being the Osborne and Headon beds of the Fluvio-Marine series, where flourish the giants of oak and beech to the tiny bog myrtle (*Myrica Gale*).

The geology of the Isle of Wight has been thoroughly explored, and little that would be of interest has been left to a chance observer. It consists of most of the formations found on the mainland, with others that have been brought to light by the action of the sea on the south coast, and by the investigations of savans and scientific men, who have been attracted here by the scenery and reputed salubrity of the climate to spend their leisure hours apart for a time from the busy world.

A ridge of chalk forms the backbone of the island, commencing at Culver Cliff on the east, the breadth being about half a mile, running westward to Carisbrook Castle, where it begins to expand until it is about three miles broad; it then contracts again to about half a mile at Mottistone Down; it then strikes the sea at Compton Bay, near Freshwater, forming the coast line to the well-known Needles, which are also composed of chalk. Detached portions occur at Shanklin to Boniface Down, curving north to Appledurcombe House; another small portion is at St Lawrence, and a third at St Catherine's Hill.

South of the chalk is to be found stretching along the coast from Cowleaze Chine to near Compton a band about a mile broad of the Weald clay, which is not found on the mainland, and which contains conglomerate sandstone, sandstone, various clays and marls. The whole of the undercliff consists of broken ground, the result of landslips and masses of rock fallen from higher levels, which, while contributing to the beauty of the scenery, have the effect of entirely concealing the underlying strata. This extends from Chine Head to Rocken End. The rest of the southern part is composed of the Lower Greensand, the Gault, and the Upper Greensand.

To the north of the chalk ridge already described two narrow belts of plastic and London clays skirt the whole length of the chalk the same as on the mainland, then follow the Lower Bagshot, Bracklesham, Barton clay, and Upper Bagshot, but in such a fitful manner that the dividing lines are scarcely distinguishable. The rest of the island north to the Solent and Spithead consists of the Osborne, Bembridge, and Hempstead beds, the first extending in a thin line by the last formations, but in a broad belt from Newport on the east of the Medina river to Cowes,

then along the coast by Ryde to Watch Point. A large deposit is to be found at Yarmouth, southwards to Headon Hill; but the largest area is occupied by the Bembridge beds, which extend from the Foreland on the east with but little interruption to Yarmouth on the west, and which consist of red and green mottled clays, above which are beds of ragstone or impure limestone, and bands of comminuted shell-limestone used for building, lime, etc.

The Hempstead beds occur in two small patches only, namely, from Hempstead Lodge on the Solent south-westward to Bouldner, and at Parkhurst Forest. It consists of laminated sandy clay, of red and grey clays, with some white and black layers between.

Such is a general view of the geology of Hampshire and the Isle of Wight, from which it may be concluded that it is not only full of interest to the geologist, but also to the arboriculturist, whom it is needless to remind that the subsoil of a country is far more necessary to take into account than almost any other consideration, and here their variety affords an opportunity, which few counties can boast of, for the student of arboriculture to make himself acquainted with the soils and subsoils which form the natural habit of certain trees.

Ancient Forests.

The Royal Forests of Hampshire have been noted from the earliest records, and appear to have outnumbered those of any other county. They were the New Forest, the forests of Bere, Woolmer, Alice Holt, and Buckholt on the mainland, and Parkhurst in the Isle of Wight. Buckholt, which is given in a list of royal forests in Queen Elizabeth's time, now only exists in name, but all the rest still belong to the Crown.

The New Forest is the largest and most important of the royal forests, having an area within its ancient boundaries estimated at 93,000 acres; but within this boundary there are about 28,000 acres belonging to various owners, leaving 65,000 as belonging to the Crown, subject to certain rights of common pasture, pannage, and fuel. The "Forest" still presents much of the same characteristics as it did a century ago, when Gilpin wrote. He says: "Its woody scenery, its extended lawns, and vast sweeps of wild country unlimited by artificial boundaries, together with its river views and distant coasts, are all in a great degree magnificent.

It must still, however, be remembered that its chief characteristic, and what it rests on for distinction, is not sublimity, but *sylvan* beauty." It, however, must be stated "that all that thou seest is *not* nature's handiwork," for many attempts have lately been made to improve it, so as to increase the revenue, but fortunately or unfortunately with but little success, and it would be much better to let nature have her own sway here, unaided by the hand of man, except to prevent waste and pillage.

The view from Castle Malwood looking towards Southampton is unequalled, except in some primeval forest; and tradition says it was here that King Rufus held high festival on the night before the fatal first of August—now near 800 years ago—when Sir Walter Tyrrel's arrow wounded him to death.

Near Brockenhurst is a large sweep of level ground called Balmoor Lawn, on which may be seen almost innumerable horses and cattle grazing in the early morn, and retiring into the dense forest to avoid the heat of the noon-day sun. Following up the course of the Brokenhurst River you come to Queen's Bower Wood, a secluded spot where the trees are of splendid proportions.

For quiet sylvan beauty, the part around Cadnam surpasses any scenery in the "forest," being beautifully studded with oaks and an undergrowth of hollies, with patches of verdant lawn. At this place is the Cadnam Oak, celebrated in that it, on Old Christmas Eve, puts forth young leaves, which may be picked on the following morning. This is no fable, as the writer of this has found it to be a fact. It stands 10 yards from the north side of the Southampton and Salisbury Road, by the fence of Widow Gain's Garden. It has a circumference of 10 ft. 6 in. at $4\frac{1}{2}$ ft. up, a bole of 17 ft., and a sheer height of 55 ft., and is apparently a young tree, although a good part of the trunk on the south side is gone—the effect, perhaps, of lightning. This is, however, being fast covered over by the growth of the tree; but it is still from 1 ft. to 18 in. broad, and extends the whole length of the trunk.

The legends that have found their way into history,—of how William the Conqueror laid waste thirty-six parishes, destroying as many churches and a great number of villages, hamlets, and scattered dwellings, driving out the inhabitants, and stocking it with deer, boars, and other beasts of chase, to gratify his love of sport,—are now generally discredited. And it is something surprising to find that such a view should have ever been entertained; for, apart from the fact that the sites of the churches and villages

destroyed have never been found, there is on record, in a perambulation in the eighth year of the reign of Edward, A.D. 1050, which was sixteen years previous to the Norman Conquest, that the boundaries of this "Forest" were more extensive then than they were when "Domesday Book" was compiled in William's reign. From this fact it may be concluded that the Conqueror decreased the area of forest, while, at the same time, he dislodged the poachers from it who preyed upon the beasts of the chase—or, in other words, made it more private for the purpose of his sport. It may be noticed that this love of the chase on the part of kings and nobles has contributed more than any other consideration to hand down to us some of the noblest of our forests.

The principal timber products of the "forest" are oak, beech, and Scots fir.

The Forest of Bere extends about three miles northwards from Havant and Portsdown Hill, and westward from the borders of Sussex, for about six miles, and contained within its boundaries in 1608 about 16,000 acres; but it may now be taken at about half that quantity, and is not of much importance either for scenery or timber products.

Woolmer Forest is to the east of Selbourne, and was enclosed and allotted in 1858, 1000 acres being reserved for the Crown. A fire broke out May 22d, 1881, and extended over some 670 acres, rendering the whole a barren waste. These fires seem to have occurred periodically; for Gilbert White, in his "Natural History of Selbourne," says: "The royal forest of Woolmer is a tract of land of about seven miles in length by two and a half in breadth, running nearly north and south. Though (by 4 and 5 William and Mary, c. 23) 'to burn on any waste land, between Candlemas and Midsummer, any grig, ling, heath and furze, goss or fern, is punishable with whipping and confinement in the house of correction;' yet in this forest, about March or April, according to the dryness of the season, such vast heath-fires are lighted up that they often get to a masterless head, and, catching the hedges, have sometimes been communicated to the underwoods, woods, and coppices, where great damage has ensued. The plea for these burnings is, that when the old coat of heath is consumed the young will sprout up and afford much tender browse for the cattle; but where there is large old furze, the fire, following the roots, consumes the very ground; so that for hundreds of acres nothing is to be seen but smother and desolation, the whole circuit round looking like the cinders of a volcano."

Alice Holt is situate about two miles north of Woolmer, and may be estimated at 3000 acres. It contains plantations of young and thriving oaks from fifty to sixty years of age, and but little ripe timber.

Parkhurst extends to over 1000 acres, and consists mostly of brushwood and small trees.

A General View.

The county may be divided into three divisions with reference to woodlands as follows :—The North, Central, and South. The great bed of chalk almost defines the boundaries of these divisions ; but, to be more particular, the boundary between the north and central divisions may be described as commencing at East Woodhay on the west, running eastward, taking in Highclere Park, Sidmonton, Ebbworth, Monks Sherbourne, Chinham, Newnham, Greywell, and Odiham ; then north-easterly by Dogmersfield Park to Fleet Pond ; then east to Farnborough Park on the borders of Surrey.

The boundary between the south and central divisions commences at Rowlands Castle on the east, on the borders of Sussex ; then westward and north of the Forest of Bere to Bishop's Waltham, Fisher's Pond, and Otterbourne ; then north of Hursley Park to Parnholt Wood; then following nearly the line of the old Roman road from Winchester to Salisbury, to Horsebridge and Whiteshoot Hill, north of Norman Court, on the boundary with Wilts. Standing on this hill and looking north, a vast treeless plain meets the eye ; but on turning to the south, there is apparently but one boundless forest stretched before you, and as far as the eye can reach.

The acreage of woods and plantations for the whole county is returned at 105,489 acres, or about one-tenth of the total area. The adjoining county of Sussex is returned at a higher percentage ; but it is doubtful whether, acre for acre, Hampshire does not produce more timber than Sussex, as the coppice land in the latter is more destitute of trees than the former.

The Woods within Living Memory and their Present State.

The area and quantity of timber grown have considerably decreased within these last forty years. This has arisen, first, from

the rage that sprung up for grubbing the small coppices and hedgerows dividing fields, and so increase the area of the arable land, to meet an improved system of husbandry; and, secondly, from the impecuniosity of landowners generally, who had to resort to the more extensive felling of timber to meet the decrease, from year to year, of the receipts from the farming land. This, at the present time, is still going on, with the exception of grubbing up the coppices, which has ceased. But as there is no prospect of the arable land increasing in value—on the contrary, it does not yet seem to have reached its lowest point—the felling of timber must still be going on, and fortunate it is for the landowner who finds himself with a breadth of woodland to fall back upon to meet the depression in agriculture. To make up for this increased and increasing felling of timber, it has to be reported that there is no corresponding increase in the planting or care of rearing trees, arising partly from the want of money, and partly from the absence of interest in forestry on the part of landowners generally; the "heroic line of husbandry," as Washington Irving calls it; and says: "It is worthy of liberal, freeborn, and aspiring men. He who plants an oak looks forward for future ages, and plants for posterity. Nothing can be less selfish than this. He cannot expect to sit in its shade, nor enjoy its shelter, but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile, and shall keep on flourishing, and benefiting mankind long after he shall have ceased to tread his paternal fields." Such was the old squire in "Bracebridge Hall," and it is to be feared that he has left few successors; for, with some experience of the principal estates in the country, I cannot find many who have been imbued with the same spirit as their fathers. The facilities now afforded for travelling are inimical to that attention more than ever necessary for the proper managing of landed property. A time was when land could take care of itself; but the times are altered, and it is necessary now for owners to give more attention to the management of their property than formerly, but unfortunately the reverse is the rule.

Prospect.

From the foregoing it may be guessed that the writer of this does not take a sanguine view of the future. From the peculiar position of landowners, and their habits, the management of the woods is too much in the hands of men but ill qualified for the

trust reposed in them. Their experience goes little beyond "the squire wants money," so the growing, the ancestral, the picturesque, or, it may be, the historical tree must go, because "our squire wants money;" but in my experience the squire sometimes comes home in time to cancel the intentions of his too zealous woodman. Many instances of this have come under my own observation. Time was when most noblemen and gentlemen would not allow a tree to be cut until they had personally inspected it; and, in particular instances, they would survey the spot from the different parts of their estate, to see what would be the effect when it was taken away.

This county reproduces freely all the common forest trees, so that little is left to the planter except an intelligent care in the rearing and after management of the trees produced naturally; but, in the hands of the present managers, very little can be expected in this direction.

The Trees of the County, with their Value.

The Common Oak (*Quercus pedunculata*) is entitled to the first notice, both on account of its value and the quantity grown, as it is to be found in all parts of the county; and it is estimated that at least two-thirds of the timber consists of oak. The best timber grows on a deep stiff clay, on a gravelly or chalk subsoil. The many uses to which oak timber is applied need not be enumerated here, but it has been observed, that although some other descriptions of timber may be harder, some more difficult to rend, some that can bear a horizontal or lateral strain better, none contains all these qualities united in such a superior degree as oak. Taking an average of the last thirty years, the price has not varied much, although there has been fluctuations from one year to another, owing, in a great measure, to the varying price of bark. The price taken standing, including the bark, will be:

Under 10 ft. meetings	at	60s. to 70s.	per load of 50 ft.
10 ft. and under 20 ft.	do. at	70s. to 100s.	,,
20 ft. ,, 30 ft.	do. at	100s. to 120s.	,,
30 ft. and upwards	do. at	120s. to 150s.	,,

Remarkable Oak Trees.

The largest specimen stands in a meadow to the east of Oakley farm house, from which it is separated by a branch of the river

Test, leading to Mottisfont Abbey pleasure grounds, some half a mile distant. It has the large circumference of 31 ft. 6 in. at 4½ ft. up. On the south side, at 9 ft. up, it branches into six large but hollow limbs, where, owing to the swell of the branches, the circumference is much larger. The diameter of the spread of branches from north to south is 22 yds., and the sheer height is 27 ft. The young branches still put out their leaves and bear acorns with all the freshness of youth. No doubt the top had been pollarded at some distant date, as I find by a map of 1805 that the meadow where it stands is called "Hollow Pollard Meadow," and if we add the word "oak," it becomes "Hollow Pollard Oak Meadow." The entrance to the interior is on the north side, and is 3 ft. 7 in. high, 1 ft. 8 in. wide, and is said to be decreasing in size, as the bark is forming round the edges of the aperture, which presents a smooth surface, making it easy of entrance. The inside diameters are, at the ground, 9 ft. by 9 ft.; and at 4½ ft. up, 7 ft. by 7 ft. This is the smallest diameter of the hollow trunk. The larger diameter would give an area of 63 square ft., and the smaller area would be 38 square ft., which might afford standing room for twenty persons. The tree, if sound, would contain 576 ft. of timber. Viewed from a distance it has a short, squat appearance; but no doubt at one time it had a different look. It is, however, probable that it has retained its present state for centuries past, and may for centuries to come, for it shows no sign of decay; but as to its age or history I can find no records. Perhaps the monks of the adjoining abbey held high jinks here, or carried the faggots from the top to light their fires. I have found no accounts of its measurement further back than 1858, when it had a girth of 31½ ft., the same as now. It grows in the alluvium formed by the river Test, and where the chalk dips under it in the valley.

To the south-east of the monument in Hurstbourne Park (Lord Portsmouth), near Whitchurch, in the low ground, and on the boundary between the parishes of Hurstbourne Priors and Whitchurch, stands "Seven Yards Oak." This is an old tree, showing signs of decay, and although apparently sound in the trunk, it does not look so healthy as the "Oakley Oak," at Mottisfont, to which it stands second in girth. It is not known how long it has borne the name, "Seven Yards," but 21 ft. is still the circumference; the soil is clay, subsoil chalk. After the above specimens, several may dispute the claim for the third place in the notable

list of oaks. In Hursley Park, near Winchester, near the Southampton gate, stands one that was, within living memory, a fine specimen; it, however, began to show symptoms of decay, when the late Sir W. Heathcote, about ten years ago, had the soil removed from around the roots, and replaced with fresh mould. Having visited it several times since this was done, I can say that it is reviving, and that the leafage is increasing, and altogether it looks more healthy. I think that, if this process had been adopted sooner, in all probability its decay would have been arrested. It has a circumference of 17 ft. 10 in.; a small protuberance comes in the way of the tape at 4½ ft. up, which, if avoided, reduced the girth to 17 ft. 7 in.; the butt is 10 ft. long. Another very picturesque oak stands in a dell near Dog-Kennel Pond, which has a girth of 17 ft. 8 in.; soil, deep stiff clay; subsoil, chalk. In Elvetham Park (Lord Calthorpe), south of the house, stands another oak with a circumference of 17 ft. 10 in., a bole of 22 ft., and a sheer height of 70 ft.; soil, clay, in the Bracklesham beds.

Just within the entrance gate to Middleton House, near Whitchurch, stands a grand oak with a circumference of 16 ft. 6½ in., a bole of 25 ft., and the whole tree contains 576 ft. of timber. This tree, taking all its points into consideration, has no compeer in this county.

With this specimen I will leave following the sizes of the various oaks which I have measured in the county, and turn to one which strikes the eye of the most careless observer. It is near the "Hunter's Inn," Woodley, Romsey, on the north side of the road to Winchester; the bole may be put at 18 ft., but a leader of a smaller size tapers to the whole height of the tree. At 9 ft. up it begins to throw out branches, and up to what may be considered the top of the bole, namely, 18 ft., these branches leave at all angles, from the horizontal to the perpendicular (none of timber size), and with a regularity almost artificial, for, when denuded of its leaves, it appears as if trained against a wall; and whether viewed from north, south, east, or west, it appears equally the same; the head forms a large dome, which, on November 28th, 1884, was one mass of green leaves, hardly a leaf turned, which was in singular contrast to all the others around it. This peculiarity of the tree is very remarkable, especially as that season was unusually fine, and so thoroughly ripened the wood that few leaves on any other deciduous trees were to be seen.

This peculiarity, and the habit of growth, have led some to suppose that it is a different variety from the common oak; but, so far as I could judge from the acorn and leaf, it is *Quercus robur*, var. *pedunculata*. The circumference was, in 1878, 11 ft., and in 1884, 11 ft. 8½ in., thus giving an annual increase of 1·416 in., which shows it is thriving. The sheer height is 80 ft., and the diameter of the head about 70 ft.; but no measurements or description can give an idea of this superb specimen of the oak; soil, loamy clay, in the Bracklesham beds.

The next I have to notice is remarkable in having been planted by the late Canon Beadon in North Stoneham rectory grounds, near Southampton, when home from school, at the age of fourteen years, the same having been raised from an acorn in a flower-pot by his sister. The Rev. Canon died June 10, 1879, having lived to sit under this oak, now a considerable tree, and witnessed a cricket match when he had attained his 100th year. The circumference is 11 ft. 3 in., and if it was planted as stated, it would be at the date (1879) of my measurement eighty-seven years of age; this would give an increase of circumference at the rate of 1·551 in. per annum; soil, vegetable loam, in the Bracklesham beds.

N.B.—To avoid repetition, all the girths are taken at 4½ ft.

The Durmast (*Quercus sessiliflora*), or "Dur Oak," as it is commonly called here, is plentiful enough throughout the county, but it is not considered to be a native, and when or by whom introduced is not known. Perhaps it "came over with William the Conqueror." It is, however, thoroughly naturalised, and is easily distinguished from the common oak by its leaves and acorns, and to an experienced eye it may be detected by the crenulated appearance of the bark. The timber is said to be porous, and open in the grain, and more liable to dry-rot than the common oak; while, on the other hand, it is said to resist the attacks of insects better, and that spiders do not weave their webs on the beams. I have, however, seen beams free from cobwebs, and apparently for no other reason than that there was some peculiarity in the timber composing them. The timber merchant will take the Dur Oak along with the common oak at the same price; indeed, it may be a question with many of them whether they know the difference.

In no other part of the county is this variety so plentiful as in the large extent of wood commencing near Crampmoor School Chapel, and extending north-easterly for about four miles to Hursley Park, and known by the names of Newpound Wood, Outwood,

and Ampfield Wood. Here they abound, of all ages and sizes. In a meadow, on the north side of the road, opposite Crampmoor School, is a very fine one, with a circumference of 10 ft. 3 in., a bole of 9 ft., and a height of 70 ft. It has a fine rounded head, spreading its boughs in every direction to a diameter of some 23 yards; soil, sandy clay, in the Bracklesham beds.

Proceeding along the road to Winchester, and in the wood on the left, just as you enter Hursley parish, and well seen from the road, is one which, though not large, is a fine timber stick, with a girth of 7 ft. 5½ in., which it maintains for 30 ft. up. It is umbrella headed, with a sheer height of 45 ft.; soil, sandy clay, in the Bracklesham beds.

In Ampfield Wood, on the west side of the coach road from Outwood Lodge to Hursley Park, at a place called "Salisbury Hill," there is another fine timber tree, with a circumference of 7 ft. 2½ in., a bole of 40 ft., and a sheer height of 60 ft.; soil, stiff clay, in the London clay.

On the east side of the coach road leading from Knapp Lodge to Hursley Park, in the same wood as the last, and between the "big" and "little fir hills," there is one with a circumference of 10 ft. 5 in., a bole of 26 ft., a sheer height of 90 ft., and a spread of branches from north to south of 22 yards; soil, clay, in the London clay. This is the finest specimen I have to record. In 1884 the common oaks in these woods were loaded with acorns to an extent, and of a size, seldom before witnessed. The Durmast oaks were not so; but whether this is a characteristic of this variety my experience does not enable me to give an opinion.

The Beech (*Fagus sylvatica*) may come next, but although not so plentiful as in former years, when large quantities were felled all over the county, and sold from 2d. to 4d. per foot, it still occupied the place next to oak. It is used for piles for docks, in turnery, handles for tools, chair-making, upholstery, and as staves for an outer covering to liquor casks for abroad. The price ranged from 6d. to 1s. per foot.

Remarkable Beech Trees.

On the Rotherfield Park estate, near Alton, in a larch plantation, there is one with a circumference at 4 ft. up, where it gives forth its branches, of 26½ ft. This is a fine ancient specimen

The spread of its branches is 23 yards, and it is otherwise remarkable for its numerous natural ties, caused by the branches growing into each other; soil, clay, on the chalk.

The "Blacksmith's Beech" stands on the west side of the Romsey and Winchester road, 13 yards from the same, and at about 3 miles from Romsey. The circumference is 22 ft. 3 in., and it divides into two gigantic limbs at 5 ft. up; the west limb has a girth of 15 ft., and the other 13 ft. Both ascend about 22 ft., then branch into two, then many. The diameter of the spread of branches is 105 ft., and the sheer height is 110 ft. The "Blacksmith's Beech," whether we consider the large circumference of stem, the great height it has attained, the area of the ground covered with its branches, or its evenly balanced symmetrical head, must be placed among the noblest specimens of the beech in Great Britain. Twenty-three yards further north, on the south edge of a clump, is one with a circumference of 8 ft., a bole of 60 ft. as straight as a gun-barrel, and, it is hardly an exaggeration to say, nearly as smooth; they call it the "Blacksmith's Fowling-piece." It is difficult to conceive that this straight, cylindrical shaft, without a branch or the appearance of one for 60 ft., was once a small zig-zag, branchy tree, but such is the habit of the beech when young. The soil is a sandy, gravelly yellow mould, on the Lower Bagshot beds.

In Paultons Park, near Romsey, by Robin's Coppice, is one with a circumference of 17 ft.; and another at Wherwell Priory, near Andover, girthing 16 ft. 9½ in. One in "Round Bush Copse," "Harewood Forest," measures 15 ft. 4 in.

I have just one more to notice. In Little Somborne Park (Sir F. Bathurst) is one with a circumference of 9 ft. 6 in.; and at a distance of 10½ ft. there is another with a girth of 2 ft. 4 in.; this, the smaller one, at a height of 27 ft. from the ground, grows into, and is entirely absorbed by, a bough of the larger one; after this junction, and it is complete, the bough is larger, showing that it derives and makes use of the nourishment from the smaller one. It is difficult to account for this freak of nature, or to say whether some cunning hand has not been at work here; but whichever it is, we will name it the "Banyan Beech."

Elm will rank next to Beech in the quantity grown in the county, although it is almost entirely confined to hedgerows, clumps, and avenues, and forms no woods of any extent. There

are several varieties of elm, but the most frequently grown is the common English elm (*Ulmus campestris*). The other varieties are the Wych (*U. montana*), the smooth-leaved (*U. glabra*), the Cornish (*U. cornubiensis*), and the Dutch or cork-barked *U. suberosa*). All these varieties may be, for timber purposes, taken as elm, with the exception of the Wych, which commands an exceptionally high price for boat-building, but it is scarce. The other elms are in demand for keels of ships, planking, coffin boards, seats of chairs, wheel stocks, etc. Notwithstanding the number of trees which were uprooted by the great gale of October 1881 and subsequent storms, when elm descended to an almost nominal price, the value may be quoted as follows :—

Under 20 ft. meetings,	at 6d. to 7d.	per foot.
20 ft. and under 40 ft. do.,	at 7d. to 11d.	,,
40 and upwards, do.,	at 11d. to 16d.	,,

Remarkable Elm Trees.

Broadlands Park, near Romsey (Lord Mount-Temple), is rich in specimens of elm, but the one that commands our attention is at the commencement of a row running north-west by the dairy-house. It has the large circumference at 4½ ft. up of 24 ft. 7 in., and at the ground 25 ft. 2 in.; at 9 ft. up it branches into two immense limbs, and attains a sheer height of 110 ft. It is in perfect health, and as seen from the river front of the house it has a grand appearance; soil, deep alluvial, on the Bracklesham beds.

In Wherwell Priory grounds, by the road from Wherwell to Longparish, is one with a circumference of 20 ft. 10 in., which at 10 ft. up branches into four large limbs, with a total height of 110 ft.; soil, alluvium; subsoil, chalk.

In front of Dogmersfield House, between the forks of the coach road, comes the third in the list, with a girth of 19 ft. 1 in., or only 1 ft. 9 in. less than the one at Wherwell, but it is not so healthy looking, and stands high and exposed; soil, sandy clay, on the London clay.

Many throughout the county are to be found girthing from 17 ft. downwards, and most of them are fine timber trees.

The Wych Elm (*Ulmus montana*).—The largest specimen stands in Weir Mead, Tufton, near Whitchurch, and has a circumference of 15 ft. 7 in. The second is in Weir Mead, Hurstbourne Park, with a girth of 15 ft. 0½ in.; and the third is on Garlic farm,

King's Sombourne, near Stockbridge, measuring 11 ft. 2 in., forking into two at 7 ft. up.

Of the upright growing Cornish Elm (*Ulmus cornubiensis*), there are a few fine trees in the county. Three miles from Winchester, down the fertile valley of the Itchen, is Shawford Park (Sir Charles Frederick). On entering the park by the wicket from the stables, there is one on each side, girthing 7 ft. 10 in. and 8 ft. 10 in. respectively, and reaching a sheer height of 130 ft. They are fine trees, and the leader goes almost as straight as a larch to the top; soil, rich alluvial, on the chalk.

About a mile and a half from here, south-west across the downs to Otterbourne, and in the grounds of the authoress of the "Heir of Redclyffe" (Miss Yonge), there is one with a circumference of 8 ft. 3 in., and a height of 115 ft.; soil, alluvial, on the plastic clay.

There are no specimens of the other varieties of elm worthy of note.

The Ash (*Fraxinus excelsior*), in comparison with our other common trees, is getting scarce in the county, and is steadily rising in price, as it can be used almost for any purpose; and in many cases it has no substitute for the coachbuilder, wheelwright, boatbuilder, and for capstan bars, handles of axes, spades, picks, hammers, and other tools. The price may be stated at from 1s. to 2s. 3d. per foot.

Remarkable Ash Trees.

Headley Park, to the north of Woolmer Forest, is an ancient demesne, now the seat of Sir Henry Keating. On the north slope of the park is an ash with a circumference of 17 ft. 8 in. at 4 ft. up, and at 4½ ft. it branches into six limbs, which have a spread from north to south of 27 yards. This is altogether the finest specimen I have seen in the county; soil, clay, on the Folkestone beds.

In Hurstbourne Park, to the east of the mansion, near two large oaks, is a fine tree, with a girth of 16 ft.; but, unfortunately, my notes give no other details of it; soil, clay, on the chalk.

On the fosse of the ruins of Merdon Castle, in Hursley Park, once a stronghold of Bishop de Blois, brother to King Stephen, is another with a circumference of 15 ft. 1 in.; it is hollow and otherwise decayed, which, however, is in keeping with the decaying grandeur of this ancient pile; soil, moved chalk.

In the valley of the river Test, at Longparish, and by the side

of the road to Whitchurch, opposite a drinking-fountain erected in 1868 by the late vicar, the Rev. H. Burnaby Greene, is one with a comfortable seat in the hollow trunk, called "Ashburn Rest." Long may it remain to rest the wayfarer, and as a monument to the memory of the worthy vicar. The circumference is only 9 ft. 10 in. The "Grindstone Ash," near, has a circumference of 7 ft. 5½ in.; soil, alluvium, on the chalk.

Three weeping ashes grow below Hartford Bridge, on the Great Western Road, which have a girth of 4 ft., 3 ft. 9 in., and 4 ft. 4 in. respectively; the largest stands next to the bridge; soil, deep alluvial.

The Yew (*Taxus baccata*) is very plentiful in this county, and is to be found in almost every description of soil, from the rugged veteran on the wind-swept chalk downs, sometimes clinging on the face of some chalk excavation, or on a ruined wall; to the well-grown tree in the fertile valleys; and this county must have supplied in early times a large quantity of bows for warlike as well as sporting purposes. On some of the chalk slopes that occur in such parishes as Hursley and Ashley at the present time, the young seedlings can be numbered by thousands, but it forms no woods of any extent. The chief use of the yew in olden times for making bows is well known. It is now used for rustic work, and in fancy cabinet work it forms a beautiful red vein; but the cabinetmaker would rather any other wood, as it does not hold the glue. In gate posts, flood-gates, etc., it will well-nigh last for ever. Price, from 6d. to 10d. per foot.

Remarkable Yew Trees.

In the churchyard of Selborne is the finest specimen in the county. It stands on the south side of the church, and the best view of it is obtained from the south-east. It is very remarkable that Gilbert White, in his "Natural History of Selborne," does not mention this tree. This circumstance is unaccountable, as he has taken notice of almost every notable thing in his native place in his interesting and instructive letters, which were written about 100 years ago. It has the large circumference of 25 ft. 2 in., a sheer height of 55 ft., and spreads its branches from north to south 22 yards. There is a tradition that it is 2000 years of age. It is, however, in vigorous health, the leaves having that deep, dark colour which indicates a thriving tree, and it

is without a flaw in trunk or branches; soil, deep alluvial, on the Upper Greensand.

In the ancient churchyard of Lockerly, situate about 1½ miles to the west of Dunbridge Railway Station, on the Bishopstoke and Salisbury line, stands a yew on the south side of the church, with a circumference of 23 ft. 4 in., which is only 1 ft. 10 in. less than the Selborne one, but does not look so healthy, and has only a height of 32 ft.; soil, clay, on the plastic clay.

In a meadow, called "Nut Orchard," at the village of Hurstbourne Priors, near Whitchurch, is one with a girth of 23 ft. 10 in., which is 6 in. more than the Lockerly one, but it is a very rugged specimen, and is only remarkable for its large girth; soil, clay, on the chalk.

In Little Sombourne Park there are a number of very old yews, many of them quite hollow, riven and torn with the wear of centuries, and although not so large as those mentioned, yet, if I were to express an opinion, I would say that they were older —no doubt the survivors of the time when, in the adjoining parish of King's Sombourne, John O'Gaunt had a park and palace, and which are still held under the Duchy of Lancaster, and where there are the remains of archery butts for his retainers to practise, being a lover of the sport, as Shakespeare has it in "Henry IV.," when Justice Shallow says, on being told of the death of Old Double: "Dead! he was an excellent shot! John of Gaunt loved him, and betted money on his head,—and dead." The largest is at the back of the kitchen garden; it is quite hollow, and has a girth of 21 ft. 4½ in.; soil, clayey loam; subsoil, chalk.

On Hall Farm, Michelmersh, near Romsey, and by the side of the footpath, is one with a circumference of 20 ft. 4 in. at 18 in. up, it then branches into three limbs, the largest girthing 16 ft. 4 in. This is a fine headed tree; soil, clay, on the chalk.

One in Durley Churchyard, near Bishopstoke, has a circumference of 20 ft.; soil, alluvial, on the Lower Bagshot beds.

To enumerate all the notable yews in this county would be an essay by itself, so I have only given the largest.

The Birch (*Betula alba*) is plentiful in the north and south divisions before mentioned, but as timber it is of little value. Price, from 4d. to 6d. per foot.

Remarkable Birch Trees.

Many are remarkable for their beauty, and but few for size. The largest I have measured in the county is at Mottisfont Abbey, by the side of the footpath leading from the grounds towards Oakley Farm. It has a circumference at 3 ft. up of 10 ft. 2 in., where it branches into two limbs, measuring 6 ft. 9 in. and 5 ft. 2 in. respectively; soil, white earth, on the chalk.

By Fleet Pond, near Farnborough, are many beautiful trees. One on the west side of the coach-road to Brooke House, Hawley, measured 8 ft. 3 in. in circumference, and there are several others approaching this size in the Park; soil, sandy, on the Bracklesham beds.

On the Embley Park estate, near Romsey, the early home of Florence Nightingale, who has immortalised her name in the annals of philanthropy, there are many beautiful specimens, from the weeping, fragile, and graceful tree, to the fastigiate, upright specimen. The largest measured is by the "Sounding Arch," on the south side of the road from Romsey to Wellow. It measured 6 ft. 7 in. in girth, has a bole of 25 ft., and a height of 85 ft.; soil, mossy bog mould, on the Lower Bagshot formation.

The Maple (*Acer campestre*) is plentiful throughout the county, but few trees can be reckoned as timber, being mostly cut as underwood. It has a beautiful and ornamental appearance in cabinet work, but many trees may be cut down before finding the right grain. Price, from 6d. to 1s. per foot.

Remarkable Maples.

They seldom attain to any height, being generally low branchy trees.

The largest is in Farley Rectory grounds, which, at 3 ft. up, has a circumference of 16 ft. 4 in., it then branches into six, the largest being 5 ft. 11 in.; soil, clay, on the chalk.

The next largest stands opposite a cottage on Fullerton Farm, near Wherwell, and measures 8 ft. 1 in.; soil, alluvial, on the chalk.

The Alder (*Alnus glutinosa*) occurs in most of the damp bottoms throughout the county, and is of little account as timber, though it lasts long wholly submerged in water. Price, 4d. to 6d. per foot.

Remarkable Alders.

The largest in girth, if it can be called a tree, is in Brooke House Park; it measures 17 ft. 6½ in. at 18 in. up; it then branches into five stems, the largest measuring 6 ft. 4½ in.; soil, sandy, on the Bracklesham beds.

On the east side of the road from Romsey to Great Bridge, in Mr Drew's meadow, there are two trees, the largest having a circumference of 6 ft. 6 in., a bole of 6 ft., and well-proportioned head; soil, peaty, on the Bracklesham beds.

In Embley Park are two cut-leaved specimens (*Alnus glutinosa laciniata*); one stands on the south side of the coach road leading to Salisbury road, and the other on the north side of the same; they measure 6 ft. 6 in. and 6 ft. 9 in. respectively; soil, peaty, on the Bracklesham beds.

The Poplars are in considerable numbers in the valleys and in the low grounds, and, as fast growing trees, are unrivalled. The timber is in demand for railway brake blocks (the white, or abele, is best suited for this), butcher's trays, packing-boxes, etc. Price, from 6d. to 1s. per foot.

Remarkable White Poplars (*Populus alba*).

There is a fine specimen in Shawford Park, near Winchester; it girths 12 ft. 3 in., has a bole of 18 ft., and spreads its branches from east to west 35 yards; soil, alluvial, on the chalk.

The second in size stands in a meadow in the parish of Nether Wallop, by the side of the road from Stockbridge to Salisbury; it has a circumference of 11 ft. 7½ in., and a bole of 30 ft.; soil, alluvial, on the chalk.

On the east side of the road from Stockbridge to Longstock, and to the north of a cottage, is one with a circumference of 10 ft. 3½ in.; soil, alluvial, on the chalk.

Remarkable Black Poplars (*Populus monilifera*).

No. 1 is in Michelmersh Rectory grounds, on an exposed situation, so that the tree has not attained a great height, being branchy and spreading. It was planted by Miss Woodcock, the daughter of a former rector, on the proclamation of peace in 1815. The circumference in 1879 was 14 ft. 8½ in., making its age at

that date sixty-four years. This would give an annual increase after the rate of 2·757 in.; soil, deep clay, on the chalk.

No. 2 is a very fine tree, standing in Wherwell Priory grounds, near the vicarage. It has a circumference of 14 ft. 6 in., a bole of 45 ft. long, and contains 405 ft. of timber; soil, alluvial, on the chalk.

No. 3 is at Sherfield House, near Romsey, and has a circumference of 13 ft. 7½ in., and is a good example; soil, alluvial, on the London clay.

Remarkable Lombardy Poplars (*Populus fastigiata*).

The Lombardy poplar is plentiful in the county, especially in the valleys, but is not unfrequent on the higher grounds, where there is a sufficiency of moisture, and where it appears like "towers along the steep." The severe winters of 1879, '80, '81 killed (at least I know no other reason) a great many, both old and young; and the gale of October 14, 1881, brought many to the ground. This was the case with two fine specimens at Greatbridge House, near Romsey, the largest of which had a circumference of 13 ft. 9 in., and a height of 130 ft.; soil, alluvial, on the chalk.

At the end of the "Fox Mills," at the entrance to Broadlands Park, Romsey, there are two splendid trees, girthing 13 ft. 9 in. and 13 ft. 2 in., which attain a height of 115 ft. and 125 ft. respectively; soil, alluvial, on the Tadburn rivulet.

At the back of Longstock Mill, near Stockbridge, is a tree girthing 10 ft. 9 in., which has a height of 120 feet; soil, alluvial, in the Test valley.

At Bossington House, by the side of the road leading to Horsebridge Railway Station, is another tree with a girth of 10 ft. 1 in., and a height of 110 ft.; soil, peat, in the valley of the Test.

Remarkable Grey Poplars.

It is sometimes difficult to distinguish the difference between this variety and the White Poplar, but I believe the following are undoubtedly of the grey variety (*Populus canescens*) :—

In Elvetham Park, to the south-west of the house, is one with a girth of 12 ft., and a bole 28 ft. long; soil, clay, on the Brackleham beds.

A fine specimen is on the river front of Broadlands, Romsey,

with a girth of 11 ft. 11 in., and a bole of 48 ft.; soil, alluvial in the valley of the Test.

Two trees by "Fiddle Pond," North Stoneham Park, near Southampton, girth 11 ft. 11 in. and 11 ft. 10½ in. respectively; soil, clay, on the Bracklesham beds.

Opposite Sheppard's School, Amport, near Andover, is one girthing 11 ft. 7 in. Soil, alluvial, on the chalk.

All the above approach remarkably near in circumference.

The Trembling Poplar (*Populus tremula*).

This variety is plentiful in the valleys of the rivers and streamlets, but does not attain a large girth. The largest which I have measured is in a meadow between the road from Andover to Amport and the Pile Hill rivulet. It has a circumference of 9 ft. 3½ in. Soil, alluvial, on the chalk.

The Willows occupied a large space within the last forty years as osier beds, but now they are almost extinct, the cause being no doubt the same as led to the decrease of the coppice land, namely, to increase the pasture land.

The only varieties that approach timber size are the white (*Salix alba*) and the Bedford (*S. Russelliana*). The wood is in demand for cricket bats. Price, 1s. 6d. per foot.

The White Willow.

In the school meadow at East Tytherley, in January 1879, I measured a fine white willow, which had a circumference of 15 ft. 9 in.; and I then noted "that it was covered with mistletoe, spreading its boughs like an oak, but is showing symptoms of decay, the boughs dying and bare, with a large limb blown off. Something has shattered this venerable tree, and I am afraid that it will soon be numbered amongst the trees that were." And so it has turned out; the great gale of October 1881 levelled it with the ground. It grew in a deep clay loam, on the chalk.

In the water meadows to the west of Mottisfont railway station stands two fine specimens. The largest had a circumference in 1879 of 11 ft. 6 in., and in 1883 of 12 ft. 8 in. This would show a rate of growth of 3½ in. per annum. Soil, alluvial, on the chalk.

The next largest in circumference is near the Pile Hill rivulet, east of Cholderton farm, four miles from Andover. It measures

12 ft. 4 in., and is a thriving tree. Soil, alluvial on the chalk. On the east side of the road from Romsey to Greatbridge, on the bank of the ditch, is one with a circumference 11 ft. 6 in., and at 6 ft. up branches into two. It has small branches up to 30 ft., showing that it has been trimmed from time to time. A colony of the domestic bee has been established here for some years, showing that it is hollow. Soil, deep peat.

On the east side of the road from West Tytherley to West Dean, by a small streamlet, are two Bedford Willows, which measure 9 ft. 8½ in. and 9 ft. 6½ in. respectively. Soil, clay, on the plastic clay.

The Wild Cherry or Gean (*Cerasus Avium*).

This is plentiful, but few are left to attain a timber size, being mostly cut as coppice wood. In this county there is a variety called the "merry," which is the first native fruit hawked in the streets. It is in size between the cultivated and the wild cherry. The fruit is a deep black and very sweet. The timber may be used in cabinet work, but the price is only from 6d. to 8d. per foot.

In the pleasure ground by the haw-haw in Broadlands Park is a fine tree with a circumference of 8 ft. 2½ in. It leans slightly to one side, but is otherwise a symmetrical tree. Soil, vegetable loam, on the Bracklesham beds.

The only other gean worthy of notice is by the farm house of Dunwood, near Romsey. It has a circumference of 8 ft. 2 in., or only half an inch less than the last, but otherwise it is not so fine a specimen. Soil, clay, on the London clay.

The Hornbeam (*Carpinus Betulus*).

Although the hornbeam is plentiful in some counties, is not so in Hampshire; indeed I would have difficulty in finding a score of trees, though common enough as a hedge plant. It is valuable for cogs of wheels on account of its toughness and oily nature. Price 2s. per foot.

In Mottisfont Abbey grounds is a tree with a circumference of 7 ft. 1 in., which is the largest I have measured. Soil, clay, on the chalk.

At Kitnocks, near Botley, is the only other one I have to record. It measures 5 ft. 9 in. Soil, clay loam, on the Bracklesham beds.

The Sycamore (*Acer pseudo-platanus*).

This tree, although limited in quantity, is in demand for making trenchers, bowls, prints, fancy articles, and for cabinet work. Price from 1s. 6d. to 2s. per foot.

The largest sycamore I have to record is in Mottisfont Abbey grounds. It has a girth of 12 ft.; soil, clay, on the chalk.

In the farm-yard of Sherfield House, near Romsey, is a finely-headed spreading tree, with a girth of 10 ft. 7 in.; soil, clay, on the plastic clay.

At Wherwell Priory there is one with a girth of 10 ft. 4½ in.; soil, alluvial, on the chalk.

At Temple Farm, Selborne, anciently a preceptory of Knights Templars, there are three good samples in front of the house. The largest measures 10 ft. 4 in., with a bole of 8 ft., and some of the limbs are very large, spreading from north to south 24 yards; soil, loamy clay, on the Upper Greensand. A very handsome, though not large, specimen stands in the "Croat," at King's Somborne; it has a circumference of 9 ft. 11 in., and the head is remarkably finely proportioned; soil, clay, on the chalk.

The Lime (*Tilia Europæa*).

This is plentiful throughout the county. The timber, on account of its whiteness and softness, is valuable for pianoforte makers, modellers, etc. The supply, however, is equal to the demand. Price, from 1s. 6d. to 2s. per foot.

The largest measured is in Bramshill Park, standing in an avenue running south-west from the main avenue, and near a large oak with a brick and wooden seat round it. The girth is 16 ft. 7 in. Another one, which has been pollarded, stands by the edge of a pond in the avenue running north from the mansion, and measures 15 ft. 1 in.; light soil on the Bracklesham beds.

In a meadow to the north of the church of Abbot's Ann, near Andover, is a tree, in a row running east and west, which measured 12 ft. 6 in. There are two others in the same row which measure 11 ft. 7 in. and 11 ft. 2 in. respectively; soil, clay, on the chalk.

In North Stoneham Park, and on the south side of "Fiddle Pond," is one with a circumference of 10 ft. 1½ in.; soil, clay, on the Bracklesham beds.

The Small-leaved Lime (*Tilia parvifolia*).

Though this is said to be a native, it is rare in the county, and the only specimens I have found are in Hursley Park, where, in the pleasure grounds, is a very handsome specimen, with a circumference of 17 ft. 9 in.; and to the north of the ice-house are other two, the largest girthing 16 ft. 5 in. They are singularly picturesque, having in growth more the drooping habit of the birch; soil, clay, on the chalk.

The Lime.

This elegant tree has been more selected for forming avenues in this county than any other tree, and many of them are very fine; some of them singularly beautiful.

The lime-tree avenue at Brambridge House (Sir Thomas Fairbairn), down the valley of the Itchen from Winchester, is the finest in the county. It consists of four rows of trees, running from the front of the house towards the south-east, thus forming three distinct avenues. The main or centre one has a width, from tree to tree, of 132 ft., or exactly two chains; the two side ones have a width of 24 ft. at the north, and 27 ft. at the south end—just one yard of difference. The number of trees in each row is fifty-nine, and the whole length is a quarter of a mile; the girth of the southmost tree in the west row is 9 ft. 5½ in., and there are few, if any, larger. They have evidently been pollarded up to some distant date, say seventy years ago. This treatment, and the width of the centre avenue, have encouraged them to throw out wide-spreading branches, thus forming a magnificent vista.

At Grove Place, Nursling, once a hunting seat for Queen Elizabeth, when following the chase in the "New Forest," is one similar to the one at Brambridge, but the trees have a greater length of trunk, and do not throw out their branches so much, showing that they have never been pollarded. Grove Place, after being occupied as a private asylum, came into the hands of the late Lord Palmerston, who restored it at great expense. The avenue has a south-westerly direction from the house, and there are more trees on the east side, so as to extend it to the public road, which has a bend at this point. The length is about 260 yards, or about half the length of the Brambridge one. The width of the centre one is 100 ft., and the two side ones 20 ft., and the distance from tree to tree in the row is also 20 ft. The

second one from the road on the west side has a circumference of 9 ft., a bole of 40 ft., and a sheer height of 90 ft. The only thing that at all mars the beauty of this avenue is, that at about one-third of the distance from the road the trees are not so tall or thriving as the rest. This may be accounted for on the supposition that a layer of subsoil inimical to their growth crosses the avenue at this point; but looking from the road, or a passing glance from the railway train, this defect is not noticed, and the whole effect is very fine, the castellated style of the building harmonising well with the lofty trees.

The avenue in Winchester Cathedral yard is said to have been planted in 1784, and this is the only one for which I can give a date of planting.

The avenue at Lainston House, near Winchester, is nearly three-quarters of a mile in length, and, as it passes through a slight hollow, reduces its formal effect; the direction is due east.

I have now to notice one which approaches the church of Crondall from the north-east, and is very striking. The width is only 12 ft., and the trees 12 ft. apart in rows; the number of trees is also twelve on each side, and the height is 90 ft. On the inside they are almost destitute of the usual branchlets, but well clothed on the outside, giving the whole a most singular, and altogether an unique appearance. The churchyard having been lately enlarged, this avenue is continued the same width and distance apart—nine trees on each side having been planted in 1878.

The Spanish or Sweet Chestnut (*Castanea vesca*).

This tree, although a native of Asia, is perfectly naturalised in the county, and occupies considerable space, having been extensively planted both for timber and underwood. It makes wood faster than any other tree (the poplars excepted), and is valuable accordingly. It can be used for many purposes in lieu of oak, and as the grain is something similar it is often taken for it. On some soils and situations it is apt to be cup-shaky. The price is from 1s. to 1s. 6d. per foot.

I have not found extra large specimens of the Spanish chestnut in the county, the largest being in North Stoneham Park. It stands by the coach road to Winchester, and has a girth of 16 ft. 9 in., and a bole of 16 ft. Another one near measures 13 ft. 2 in., and has a bole of 18 ft. Soil, sandy clay, on the Bracklesham beds. In the

"chestnut avenue," Bramshill Park, there is one with a girth of 13 ft. 3½ in. Soil, sandy clay, on the Bracklesham beds.

At Mottisfont Abbey there is one with a circumference of 11 ft. 4 in. Soil, clay, on the chalk.

The Horse Chestnut (*Æsculus hippocastanum*).

This is also a native of Asia, but has been freely planted as an ornamental tree, and as such it has few equals in a park. It is used for much the same purposes as sycamore, but it is very seldom in the market. Price, from 1s. 6d. to 2s. per foot.

The largest specimen I have to note is in the rookery at Wherwell Priory. It girths 17 ft. 3 in., and is a very fine growing tree. Soil, alluvial, in the valley of the Test.

To the east of Hurstbourne Priors church there is one with a girth of 15 ft. 10 in. Soil, alluvial, on the chalk.

Near the school at Over Wallop are eight trees, evidently part of the remains of an avenue. The largest has a circumference of 14 ft. 7 in. Soil, gravelly clay, on the chalk.

In Little Sombourne Park, in front of the house, is a very fine specimen, with boughs sweeping the ground. It has a girth of 14 ft. 0½ in. Soil, gravelly, on the chalk.

An avenue running south-easterly from the front of Broadlands mansion was planted in 1735, but there are now only two remaining, which girth 11 ft. and 12 ft. 4 in. respectively. As these are the only ones I have the date of planting, the calculation for their rate of growth per annum would only be ·986 in., which is a slow rate for such a reputed fast-growing tree. Soil, clay loam, on the Bracklesham beds.

The Walnut (*Juglans nigra*).

A native of Persia, but occurring plentifully in the county, and attaining to a large size, and bearing fruit nothing inferior to any imported. The wood in former days was of great value for gun-stocks, for which foreign timber is now substituted; for veneering it is still valuable. Price, from 1s. 6d. to 2s. 6d. per foot.

The largest is at Bramshot, near the Liphook railway station, on the London and Portsmouth direct line, and in front of Church farm house. It is a grand specimen, with immense spreading limbs, and has a girth at 4 ft. up, measured fairly below the swell

of the first branch, of 15 ft. The branches spread from south-west to north-east a distance of 31 yds., the whole tree being on a grand scale, its giant arms being singularly impressive as viewed from the west. Soil, a deep vegetable mould, on the Hythe beds of the Lower Greensand formation.

The next in size is at Church farm, West Tytherley. It has a girth of 14 ft. 2 in., but does not look so healthy as the one at Bramshot. Soil, clay, on the chalk.

On Mr Tom Cannon's (the well-known jockey) property at Houghton, near Stockbridge, there is a fine tree girthing 14 ft. 0½ in. Soil, alluvial, on the chalk.

The False Acacia (*Robinia pseud-acacia*).

The false Acacia, as it is commonly called, has been largely planted from the time of Cobbett, who so strongly recommended it not only for timber but as underwood, to the present. It, however, is now only appreciated as an ornamental tree, its beautiful white blossoms appearing when most of the earlier flowers, such as the horse chestnut, hawthorn, laburnum, etc., are gone. The price may be stated at from 6d. to 8d. per foot.

The following are the largest measured, several of which are in an incipient state of decay. No. 1 is at the farm stables, Mottisfont Abbey. It has a girth of 8 ft. 9 in. ; clayey loam, on the chalk. No. 2 is at Thruxton Rectory, near Andover. It measures 8 ft. 6 in., and grows on the chalk. No. 3 is at Brambridge House, girthing 7 ft. 9 in. ; soil, alluvial, on the plastic clay. No. 4 stands in front of the "White Lion" Inn, Hartford Bridge ; soil, alluvial, in the Lower Bagshot beds.

The Cedar of Lebanon (*Cedrus Libani*).

This fine tree is to be found in many parks and pleasure grounds throughout the county. Amongst them are some grand specimens, those at Highclere being the most celebrated as being the first introduced into Hampshire, which was in the year 1767, but as I have not measured them myself I will not give any account of them.

In Broadlands Park, on the south side of the mansion, by the iron gates, there are two which were planted in 1770. They are fine trees, but have been for some time losing large boughs from heavy snows and tempests. They both girth 15 ft. 2 in. each. Finer specimens stand a little further south, but whether of the same

age or not is uncertain. One has a straight bole of 100 ft., and a circumference of 10 ft. 4½ in. This one is of an unusual habit of growth, being more like a silver fir. There is also a remarkably fine one in "Pedestal bottom," which girths 15 ft. 7 in. Besides these there are many others of all ages and sizes in the park and pleasure grounds, mostly planted by the late Lord Palmerston, who for the long period of sixty-three years owned the estate, and was an enthusiastic arboriculturist.

At Southend House, Hursley, which was occupied by a nurseryman of the name of Mr Savage Beare, there is a clump of four cedars close by the main road to Romsey and Southampton, opposite the school, girthing 9 ft. 7 in., 11 ft. 8½ in., 9 ft. 2 in., and 7 ft. 10½ in. respectively. Although much smaller than those at Broadlands, they were planted the same year (1770), and it is exceedingly probable that Mr Beare, as a nurseryman, supplied the plants to Broadlands; his tomb is in Romsey Abbey churchyard; soil, white earth, on the chalk.

I have to record another of which I have the date of planting. It is at Jenkyn's Place farm, between Alton and Farnham; it was planted in 1823, and has a girth of 10 ft. 1 in., being nearly equal to the largest one at Hursley, although they are nearly double the age; soil, vegetable mould, on the Upper Greensand.

The Laburnum (*Cytissus Laburnum*).

A native of the Alps, this is plentiful as an ornamental tree, but rarely attains to timber; when it does so it commands the exceptionally high price of 3s. to 4s. per foot.

The only tree worth recording is on the lawn of a villa at Forton, Longparish; it has a circumference of 8 ft. at 2 ft. up, when it branches into four limbs; soil, clay, on the chalk.

Hawthorn (*Cratægus Oxyacantha*).

This essay would not be complete without a notice of the hawthorn, the poetical "May." It occurs in every park, and fringes every green lane and many a dusty road, while disputing for a place on the closely-cropped chalky downs.

There are two parks in this county, namely, Hursley Park, near Winchester, and Hackwood Park, near Basingstoke, which are notable for the number and age of the trees.

> " O'ergrown with lichens to the very top,
> And hung with heavy tufts of moss,"

they present such a hoary appearance, that they seem to be the oldest of all living trees. In Hackwood Park, near the bridge over the ponds, is one springing from the ground with three stems, spreading and twisting its limbs in such grotesque forms that it baffles description. Those in Hursley Park are remarkable for the quantity of mistletoe on them, giving the tree quite a green appearance in winter. As to the value of hawthorn timber, I know nothing.

The quantity of hawthorn trees in the county being so great, it would be difficult to point out the largest, or to say what is a large one; for in the course of my reading I have never seen the girth of one recorded.

The largest I have measured is in Farley Chamberlayne rectory grounds; the girth is 5 ft. 3 in., a bole of 7 ft., and a sheer height of 30 ft.; soil, clay on the chalk. The next one is in front of the "Seven Stars" Inn at Tidcombe Bridge, near Fullerton Railway Station, "with seats beneath the shade." It has a circumference of 4 ft. 3 in., and a height of 20 ft.; soil, alluvium, of the river Test.

A very fine specimen stands on the bank of a field at the cross roads on the west side of the road leading from Braishfield to Romsey. It has a circumference of 4 ft. 7 in., a bole of 7 ft., and a sheer height of 30 ft. It has a finely rounded head, and is said to blossom every year; soil, loamy clay, on the Bracklesham beds.

The Holly (*Ilex aquifolium*).

The holly is so plentiful that it has been stated that the New Forest alone contained as much holly as was to be found in all England; but this may be an exaggeration. Taking the whole county, there are few, if any, other counties that can boast of such a quantity. This especially is the case with the north and south divisions, where it is more abundant than in the middle division. The larger timber is highly prized by the cabinet-maker, turner, carver, etc.; and the smaller sticks for whip-handles, walking-sticks, etc. Price from 3s. to 4s. per foot.

The remarks as to the hawthorn may be taken as applying to the holly.

The largest specimen is in Dogmersfield Park, near Odiham, on the high ground to the east of the mansion, and west of a large oak. The circumference is 6 ft. 6 in., the bole 8 ft., a height of

25 ft., and a spread of branches from north to south of 38 ft.; soil, sandy clay, on the Bracklesham beds.

On the north side of the drive leading from the blacksmith's shop, Ampfield, near Romsey, to the fields, is one with a circumference of 6 ft. 4 in., or only 2 in. less than the one at Dogmersfield; the bole is 6 ft., and the sheer height 25 ft. It has hardly any spread to its branches, consequently is not so fine a specimen as the first; soil, gravelly clay, on the Lower Bagshot.

I have selected the above two as having the largest girth, but many are more symmetrical in form, girthing from 4 ft. downwards, and attaining a sheer height of 50 ft. A very fine variegated holly stands in front of a farm house in the village of Longstock, near Stockbridge. It had a girth of 4 ft. 6½ in., and a height of 30 ft.; soil, alluvial, on the chalk.

The Scots Fir (*Pinus sylvestris*) woods and plantations are of large extent in the north and south divisions, but it does not like the chalk. Many of the bare heaths throughout the county have been covered with naturally grown trees.

Canon Kingsley, who was rector of Eversley in this county, says, in his "Winter Garden:" "I respect them, those Scotch firs. I delight in their forms, from James the First's gnarled giants up in Bramshill Park down to the little green pyramids which stand up out of the heather, triumphant over tyranny and the strange woes of an untoward youth. Seven years, on an average, have most of them spent in ineffectual attempts to become a foot high,—nibbled off by hares, trodden down by cattle, cut down by turf parers, seeing hundreds of their brethren cut up and carried off in turf fuel, —they are as gnarled and stubbed near the ground as an old thorn bush in a pasture." Notwithstanding all these difficulties, the Scots fir, as has already been said, has covered many a barren moorland in the county. The price may be stated at from 8d. to 10d. per foot.

Now for a glance at Canon Kingsley's "gnarled giants" in Bramshill Park, which form several charming avenues, and consist of some very fine specimens. The tradition is that they were planted by James the Sixth of Scotland and First of England; and, to again quote Canon Kingsley, "when he built Bramshill for Raleigh's hapless pet, Henry the Prince, or whatever may have been the date of their re-introduction, here they are, and no one can turn them out." The largest is in the north-west row of an

avenue running diagonally out of the main avenue, and is the fifth tree in the row. It has a girth of 14 ft. 7½ in., and contains 226 ft. of timber. Beside a sweet chestnut, which girths 13 ft. 3½ in., is another which approaches within 2 in. of the largest, its girth being 14 ft. 5½ in. One on the hill, opposite the "Temple," has a girth of 9 ft., and has a bough leaving the main stem at 11 ft. up, and, bending to the ground, has apparently taken root. This bough has a girth of 3 ft. 10 in.; soil, sandy loam, on the Bracklesham beds.

Between the forests of Woolmer and Alice Holt and above Headley Mill, in an alder bed on the east side of the stream, there is one with a circumference of 13 ft. 8 in., and a bole of 7 ft. It then branches into four large limbs, one being 7 ft. 6 in. in girth, and a branch leaves the trunk at 2 ft. up girthing 3 ft. 10 in. The spread from east to west is 27 yards. This tree has more the appearance in growth of an oak, having altogether a grand effect, but which is marred to a certain extent by the crowding of the young oaks, etc., around it; soil, damp moory sand, on the Folkestone beds.

A tree which has attracted a good deal of attention, and of which accounts have appeared in different papers, stands in "Fir Orchard" coppice, in the parish of Nursling, and on the east side of the road from Romsey to Southampton. It has a circumference of 12 ft. 7½ in., the trunk 33 ft. long without a branch, and as smooth as a ship's mast. It then divides into two but unequal sized limbs, the sheer height being 90 ft.; and it contains 310 ft. of timber. To give a good view of it from the road, the Right Hon. Lord Mount Temple, to whom it belongs, has had a broad ride cut out, so that in passing along the road it is to be seen in all its massive grandeur. This tree, taking all its points into consideration, has no compeer in Hampshire.

The Larch (*Larix europæa*).

The larch has been much planted on every considerable estate throughout the county; but latterly, on many estates, where thousands used to be planted every year, there is now scarcely any; and as it does not reproduce itself, it will, unless some alteration in the means of the landowners takes place in the meantime, become scarce. Its principal use is for fencing and railway purposes, the

builder being shy of it, as it is so liable to warp. Price, 8d. to 1s. per foot.

There are, of course, many handsome specimens of larch in the county, but none of a remarkable size. I notice two in the pleasure grounds of Cranbury Park, near Winchester. One has all the characteristics of the tree—fine pyramidal shape, with branches sweeping the lawn; but the circumference is only 6 ft. 3 in. The other is in singular contrast, and is remarkable for its bushy habit of growth, altogether unlike the larch. Its circumference at 4 ft. up, and below the first bough, is 10 ft. 3½ in.; soil, sandy clay, on the Lower Bagshot.

One, at Amport Rectory, near Andover, has a circumference over the ivy of 7 ft. 2½ in.; soil, clay, on the chalk.

At Bramshot Cottage, near Liphook Station, another measures over the ivy 8 ft. 2 in.; soil, vegetable mould, on the Lower Greensand.

I think it probable that some, if not all, of the above were amongst the first planted in Hampshire, as the situations seem to indicate that they were planted at a time when the tree was rare.

The Silver Fir (*Picea pectinata*).

This has been principally planted as an ornamental tree. On any elevated situation they can be seen towering above all the other trees of the forest, forming landmarks as far as the eye can reach. The whiteness of the grain, and its satin-like lustre as timber, do not seem to be known here. The price is from 6d. to 8d. per foot.

In Paultons Park there are several fine examples. One to the south-east of the mansion has a circumference of 14 ft., and a total height of 130 ft. This is a fine tree, feathered almost to the ground. The "Siamese Twins" may be one tree, they are so closely united. Their circumference is 17 ft. 4 in., and that of the largest is not less than 13 ft. 6 in., but it could not be accurately measured; soil, sandy clay, on the Bracklesham beds.

In Grove Place Copse, Nursling, there is one with a circumference of 11 ft. 2½ in., dividing into two at 35 ft. up; sheer height, 110 ft.; soil, clay, on the Bracklesham beds.

On the high ground in Cranbury Park are several fine specimens, which are seen for many miles around. The largest measures 11 ft. 5½ in., and has a height of 130 ft. Near it is one with only a girth of 7 ft. 5 in., but attains to the same height as its neigh-

bour, namely, 130 ft. ; soil, gravelly clay, on the Bracklesham beds.

In the celebrated "Fir Avenue" in Bramshill Park there is one girthing 10 ft. 3 in. This tree and others in the same avenue are perfect, but they do not attain to such a height as some others with a smaller girth, being only from 90 to 100 ft. ; soil, moory sand, on the Upper Bagshot.

The clumps of High Cockolorum at the Andover Lodge of Hurstbourne Park are very conspicuous, attaining a height of 120 ft., and the largest has a girth of 8 ft. 7 in. The seedlings here are abundant ; soil, clay, on the chalk.

The Spruce Fir (*Abies excelsa*).

This tree has not been planted to any extent, and where it has, the situation has not generally been well selected, mostly on the elevated and exposed chalk downs, the result being that the belts or clumps where it has been planted show only stunted and ill-grown specimens. Price, from 4d. to 6d. per foot.

None of the specimens I have seen exceed 110 ft. high. At Ampfield House, near Romsey, there is one with a circumference of 7 ft. ; soil, clay, on the Bracklesham beds.

In Little Somborne Park there is one with a circumference of 7 ft. 1½ in., just below where a branch leaves the trunk. This branch has a girth of 3 ft. 8½ in., which gives to the tree an unusual appearance. Soil, gravelly, on the chalk.

At the south of the pleasure grounds, Cranbury Park, a very fine specimen has a circumference of 8 ft. 4 in. This is the largest I have to record ; soil, clay, on the Lower Bagshot.

Coppice Wood.

The underwood is of considerable extent in the county, being found in most woods consisting of deciduous trees, and forms a very important industry. It is generally cut at from eight to twelve years of age. It is sold mostly standing to a class called "wood dealers," who cut it and manufacture it into the various goods for sale ; and in few counties is there so much skill displayed as in Hampshire in cutting and sorting the wood for the various uses, and in utilising the whole.

The Hazel (*Corylus Avellana*) is the most plentiful as well as

the most useful of all the underwoods. It makes the best hoops, hurdles for sheep, crate rods, spars, pea stakes, withes, etc.

Ash is not so common, but is valuable for its quick growth and the uses it is fit for, which are hop poles, hoops, hurdles, sheep cages, scarlet runner bean stakes, etc.

Oak is not so useful as ash, but some of it comes in for hoops, hurdles, crate rods, bean stakes, withes, etc.

Maple is plentiful, but is little used; occasionally for hoops, hurdles, stakes for fencing, faggots, and bavins.

Beech is of very little use, except for pea-stakes, faggots, etc.

Alder comes in for hop poles, broom and mop handles, and for gunpowder wood. When it reaches the size of 3 in. diameter it comes in for the manufacture of toys, etc.

Birch grows freely, and comes in for hop poles, hoops, hurdles, brooms, broom, mop, and rake handles, bean stakes, faggots, etc.

Sweet Chestnut is a valuable copse wood in consequence of its quick and straight clean growth, making the best of hop poles, hoops, and hurdles.

Wild Cherry is plentiful in some coppices, and is valuable for hop poles, hoops, and hurdles.

Sycamore does not often occur, but is valuable, especially for hoops.

Willows are useful for hoops, hurdles, crate rods, bean stakes, etc., but are deficient in lasting power.

Bird Cherry (*Cerasus Padus*), or what is locally called "black dogwood," is scarce, and is the wood for gunpowder.

Skewer Wood (*Euonymus Europæus*), as its name implies, is a capital wood for butchers' skewers, being tasteless, easily split, and clean in the grain. It grows best on a chalk subsoil.

Dogwood (*Cornus sanguinea*) is used for spars, withes, etc.

Elder (*Sambucus nigra*) is considered of little value, although no wood will last longer as fencing stakes, etc.

Guelder Rose or Copse Elder (*Viburnum Latana*) makes a light walking-stick, and the top is easily fashioned into shapes.

Hawthorn and Blackthorn (*Prunus spinosa*) may produce a few walking-sticks, but are chiefly used for making dead hedges, which form an effective fence against sheep for a few years. When made into bavins, they are used for bottoms to hayricks.

Crab Apple (*Pyrus malus*) is made into walking-sticks; but it is best to leave the finest sticks, as they form a very ornamental tree when in full blossom.

Mountain Ash (*Pyrus aucuparia*), locally called "scatter ash," is of little repute amongst wood-workers; although, from its tough nature and straight clean growth, it might be supposed to be useful for hoops, hurdles, etc.

Privet (*Ligustrum vulgare*) is common, but of no special use.

Holly produces walking-sticks and whip-handles, but is usually made into bavins of not much value, and it might as well be left to come in for timber or for ornament by the rides; indeed, on some estates it is a condition that it shall be left when the rest of the underwood is sold.

Buckthorn (*Rhamnus frangula*) occurs very rarely. It is reputed to be the best wood for gunpowder.

The above is an exhaustive list of the varieties of underwood to be found in the coppices and woods of Hampshire, and the different wood goods may be catalogued as follows:—1st. *Hoops*, which are made from 4½ ft. to 14 ft. in length; some are left straight, whilst others are bent. 2d. *Hurdles* for folding sheep. These are preferable to netting or iron hurdles, in that they afford a better shelter for sheep; they are also used for lining the holds of ships. 3d. *Crate rods* for making crates for crockery-ware, etc. 4th. *Pea stakes*. 5th. *Spars* for thatching. 6th. *Withes* for tying faggots, etc. 7th. *Hop poles*. 8th. *Brooms*. 9th. *Broom*, *mop*, and *rake* handles. 10th. *Scarlet runner* bean stakes. 11th. *Walking-sticks*. 12th. *Whip* handles. 13th. *Sheep cages*, used as racks for hay in the fold; and, being light in weight, are to be preferred to any other. 14th. *Skewers*. 15th. *Wood* for gunpowder. 16th. *Faggots* of sorts, principally what is called copse and frame faggots; the latter being made in a frame, and composed of the largest and best wood for heating bakers' ovens. 17th. *Bavins* are the faggots of the smaller wood, and out of which are made the small match faggots for lighting fires.

The above shows the various uses of the underwood, and that many useful articles of common sale are made therefrom.

From careful calculations that have been made for a series of years of the profit arising from underwood, it is found to range from 5s. to 15s. per acre per annum; that is leaving out of the question the crop of timber which is gradually coming on in the coppices where the underwood grows. The price of an acre of underwood ranges from £3 to £8, much depending upon age, situation, quality, and crop—the buyer, of course, doing all the labour of cutting and converting the same.

XXIII. *Hedgerow and Field Timber.* By Angus D. Webster, Forester, Penrhyn Castle, Bangor, Wales.

Although the well-founded assertion that the quantity of hedgerow and field timber throughout Britain is in excess of that produced in our woods and forests may at first appear somewhat startling and exaggerated, yet it is nevertheless a fact, and one that forcibly brings home to us that the importance of this class of timber is far greater than is generally supposed. That hedgerow and field timber, the former in particular, is, however, gradually disappearing before farm and land improvement, is a fact that is well known to the careful observer, and we may safely add that during the next quarter or half century not one-tenth of the present quantity will be retained. Regarding the utility or otherwise of this class of timber great difference of opinion exists, some, more particularly the farming community, maintaining that it is not only injurious to crops and fences, but a harbour for game and vermin; while on the other hand there are those, and fortunately they are in the majority, who are in favour of such trees, justly considering that these are the greatest improvers of natural scenery, and to which our country owes so much of its green, garden-like appearance. Partly we favour both sides of the case, and shall, previous to pointing out the most suitable trees for hedgerow and field planting, which is the principal object of this paper, briefly give our views on the matter.

That many farmers have just cause for the grievance complained of we must admit, for there can certainly be no two opinions regarding the ill effect on crops generally where an undue quantity of either hedgerow or field timber exists. Wales in this respect is far from behindhand, for the number of worthless trees that stud the landscape, and, combined with useless fences, interfere with agricultural pursuits, is truly surprising, and would hardly be credited unless by those who have travelled about through the country and paid some attention to the matter. No doubt at one time, when woods were less abundant than now, field and hedgerow trees would, in many exposed districts, be invaluable for affording shelter to both man and beast; but with the advance of the times and now fairly well wooded nature of the country generally, fully one-half of those that still exist might well be cleared away, with not only advantage to landlord and tenant, but to the general

appearance of the country as well. To those who are unacquainted with the area of ground taken up by old-fashioned hedges that are practically of no value as fences, as well as hedgerow trees, and such as are injudiciously placed in clumps, the following, as one out of many cases which came under the writer's notice in North Wales, may be pointed out. Three small fields of, on an average, 3 acres each, contained no less than 2233 yds. of 9 ft. wide fencing; or, in other words, the fields were surrounded by hedges of mixed quicks, hazel, elder, and blackthorn, placed on the top of raised mounds or dykes of soil, the whole taking up an average width of about 9 feet of ground. The combined length of fencing in the three fields was 2233 yds., which, multiplied by 3, the yards in width, gives a total of 6699 yds., or nearly $1\frac{1}{2}$ acres of good arable land taken up by trees and fences which were worse than useless for the purpose intended, being in truth what the farmer described, a harbour for vermin, and as occasioning too dense a shade for the successful cultivation of crops in their immediate vicinity. These fences have now been removed, the three fields thrown into one, and other fencing substituted, the result being a gain of about 1 acre in 9 acres, not to speak of the advantages accruing to the farmer thereby.

Similar instances of large clumps of trees exercising like mischief might also be pointed out, and that where one-fourth of the number, if judiciously placed, would not only have been more ornamental but of advantage to the farmer for both shade and shelter. These old-fashioned fences have, however, this much in their favour, that, owing to the raised mound or dyke on which both quicks and trees are planted, the roots are not nearly so injurious to the herbage in the adjoining field sides as such as have been planted on the level, but, as before stated, this seeming benefit is far more than counterbalanced by the extra width of ground used in making the dyke. With the modern system of farming and managing hedges, tree planting cannot very well go hand in hand, a fact that is every day becoming more and more apparent in the improving and laying out of farmers' fields and fences. A well-formed, well-managed quickthorn fence should not occupy more space than 3 feet in width; indeed hundreds of such on the home farm at Penrhyn, as well as on several of the lately improved farms on the same estate, are of such dimensions, they being well suited in every way for preventing the ingress or egress of cattle and sheep. Now in such fences we find it almost an impossibility to have trees,

they not only causing damage to the fence, but usually attaining to a much greater diameter of bole than the hedge's width, thereby causing inconvenience, appearing out of place, and interfering with the proper management of the fence. Under such circumstances, and where the country is but thinly wooded, judicious tree-planting in the corners of fields may be done with advantage, and will be found productive of far better results than had these been introduced along the line of fences. There are, however, several species of trees that can both advantageously and profitably be introduced to such fences, as various kinds of plum; but for the general run of forest trees they are unsuitable. Where the old system of hedge formation is still in vogue, the 6 or 9 ft. in width of ground usually allowed can well be planted at intervals with suitable forest trees, these, if well managed, doing but little harm either to the fence or adjoining land. Having now hit, perhaps rather severely, on some of the disadvantages of hedgerow and field trees, we will briefly look to the other side of the question, and treat the subject from a purely ornamental as well as profitable point of view, the latter, however, being dealt more fully with in considering the different species that are suitable for the purpose. Although it must be admitted that the primary object of most hedges is utility, still there is no reason why these should not be denuded to some extent of their stiff, uniform appearance, and become toned down by the fringe of beauty imparted by the judicious use of certain trees. In doing so, however, let the watchword be discretion, so that the work may not be overdone, for unfortunately to this latter can alone be attributed much of the grumbling that day by day jars in the forester's ears regarding the evil effects produced by immoderate quantities of hedgerow and field timber. That these, when suitably placed either in the hedgerow or open field and in limited numbers, impart an otherwise unobtainable beauty and freshness to the landscape, cannot be denied; and even those who entertain the most utilitarian ideas on the matter must confess that were the broad face of nature stripped of its trees, other than woodland, a dull, monotonous repetition of bare hill and down would be the result. From a sanitary point of view also individual trees or those in clumps are exceedingly valuable.

Suitable Trees for Hedgerow and Field Planting.—In proceeding to consider the trees that have been found most suitable for hedgerow and field planting, four important points should always be kept in view. 1. That the spread of branches is, comparatively speak-

ing, small in proportion to the tree's height. 2. That the roots have a downward tendency, or do not ramify to too great an extent. 3. That the timber value is such as to compensate in some degree for the cost of planting and after-management in the way of pruning, fencing, etc. ; and 4. That the tree is well adapted for exposed situations and standing singly. Although but rarely do we find all these good qualities concentrated in one tree, still, with careful choice and good after-management, much can be done to produce the desired effect, even in trees of a partially opposite character. That the wrong class of timber has been, and is even yet, too often planted in our hedgerows, is painfully apparent to any one who has paid attention to the subject,—trees of wide-spreading habit in both root and branch occupying positions and doing irreparable damage where, with proper selection, others of an unobtrusive nature could with advantage have taken their place. Timely and judicious pruning is of the utmost importance in the production of hedgerow timber ; but to be productive of the best results, the work must be attended to early and prosecuted at intervals, as by skilfully shortening the branches from time to time the spread of root is likewise to a great extent prevented, thereby securing as it were a double benefit for the farmer. The renovation of old and neglected trees is, however, not so easily managed ; for care must be taken not to prune or cut within several feet of the tree's bole, but at such a distance outward, and in such a way, that the minor and secondary branches may be preserved.

Now, as to the most suitable trees for field and hedgerow planting, nothing in our opinion approaches the Cornish elm (*Ulmus Cornubiense*)—a tree that unfortunately is far too seldom seen either as a standard or in our woodlands, and for which the nurseryman more than the planter is responsible, for it is not propagated in anything like sufficient quantity for the demand.

As a park or fence tree this distinct and well-marked variety of the elm has much to recommend it, such as narrow spread of branches in proportion to the gigantic height it attains, suitability for exposed situations, value of timber produced, and last, but by no means least, the very decided ornamental character it imparts to the landscape when properly placed. Near the seashore at Penrhyn Castle, both as a woodland and standard tree, the Cornish elm has done well, specimens of from 60 ft. to 80 ft., and girthing 6 or 7 ft. at a yard up, being not uncommon. The narrow spread of branches is, however, the chief point of recommendation ; for even

in the trees just referred to this does not usually exceed 5 or 6 yards, with no large boughs, but as if all the strength was exerted in the production of clean, straight stems. As a timber tree the Cornish elm has not yet been fairly tested, although, for my own part, I am fully convinced that it quite equals the parent form, unless in the graining of the wood, to which it is decidedly preferable, as any one must acknowledge after an inspection of the planks preserved here. Five years ago a large tree of this elm was broken over, part of the trunk being used, experimentally, for repairing a vessel in the Menai Straits; but sufficient time has hardly elapsed for opinions to be hazarded. So far, however, I may say the results are satisfactory.

In Hampshire, growing on rich alluvial soil on the chalk, the Cornish elm has attained a height of 90 ft. in 40 years, with a circumference of $4\frac{1}{2}$ ft. at a yard up. At Stamford House, in the same county, two of these trees—one on each side of the wicket entering the park—have attained a height of fully 130 ft., with girths of between 8 and 9 ft. at a yard up. The principal advantages of this tree, either for hedgerow or field planting, are that no pruning is required to keep the branches in bounds; that the spread of branches is very small in proportion to the tree's height; that the roots do not approach too near the surface, or ramify to a great extent, so as to become injurious to crops in their immediate vicinity; and that the quantity and quality of timber produced is such as to compensate for the expenses connected with planting and after-management.

The English elm (*U. campestris*) is another tree of great value for hedgerow and field use; and is, perhaps, more commonly used for these purposes than any other. Like the Cornish variety, though in a much less degree, it has an upward inclination, the ramification of its branches being narrow in proportion to its height; while as an ornamental tree and valuable timber producer it has few equals. It also admits of being placed *in situ* when of a large size, this being a recommendation in its favour where ground game abounds; while, as regards choice of soil, it is by no means particular, so as it is not over damp or containing stagnant water, a rather dry sandy loam suiting it best. The wood is valuable, and in demand by the cart-wright, coach-builder, cabinet-maker, as well as for coffin boards, and in the construction and repairs of sailing vessels and pleasure boats. Should necessity demand it, the elm may be pruned without fear of harm; but it is not one of the best subjects

for such an operation, unless the work is timely and carefully performed. In some of the midland English counties the elm is kept closely pruned up from its infancy, the practice being supposed to favour the production of tough, gnarled timber. As the lower branches particularly seldom spread to a great extent, and are not usually very abundant near the ground, the English elm is thus well adapted either for hedgerow planting or standing singly in fields and parks, which, combined with the shelter it affords and quality of timber produced, as well as ornamental character, renders it one of the best trees for use in the places under consideration.

The British oak (*Quercus Robur*) is of about equal value with the elm for hedgerow planting; indeed, by careful manipulation, it is even superior to that tree, being, perhaps, less injurious to the herbage beneath it, while its roots have a much greater downward tendency than those of the elm. As an ornamental tree and valuable timber producer, the oak requires no praise from us, these qualities having been well set off from almost the earliest date.

It bears pruning with impunity, so that all ungainly or far spreading branches can be cut back or foreshortened at pleasure; while those near to the ground, and that in any way interfere with the fence or crops, can, by judicious management, be altogether removed, not only with advantage to those latter, but, when carefully performed, with increased value to the tree as a timber producer.

Any soil suits the oak; but the first and clearest timber is produced on strong, deep loam, and in partially sheltered situations, the tree usually assuming a stunted, many-branched habit of growth where fully exposed and growing in poor, thin soils. Several varieties of the oak are equally well adapted for hedgerow or field planting, more particularly such as have a partially upright inclination and are of strong robust growth.

The Lombardy poplar (*Populus fastigiata*).—Although of but little value as a timber producer, yet, as an ornamental tree of singular habit and appearance, the Lombardy poplar is certainly unique amongst our hardy, deciduous trees. When planted in judiciously arranged clumps in the corners of fields, or singly in the hedgerows, this poplar produces a most pleasing effect in the landscape; and being of close, fastigiate growth, is not in the least injurious to crops in its immediate vicinity.

No tree is, however, more readily misplaced than the one in question; and, in planting, it is well to avoid the prevalent mistake

of placing in lines, squares, round or oval forms, or even in single specimens, but as seldom as possible, these methods being highly objectionable and devoid of good taste, that is if we desire to preserve in the landscape a natural appearance. Few trees grow so fast, and with so little injury to others, as the Lombardy poplar; but it is very impatient of confinement, and must have room and air where healthy well-branched specimens are desired. Cool, damp soil, by the side of a stream or river, is that best suited for perfect development of this tree, although it thrives in a fairly successful manner, and attains large dimensions in soil of very ordinary quality and without superabundance of moisture. It never requires pruning, and being of a strong, sturdy nature, seldom becomes damaged or upturned, even during the most severe weather. The wood, as before stated, is of but little value, although for the making of barrows and bottoming of carts it has acquired some reputation, from its being less inclined to split than to gradually tease away.

The sycamore (*Acer Pseudo-platanus*), as a standard tree, either in field or fence, is worthy of attention, not only for its well-known ornamental character, but value of wood produced; it, in this latter respect, being second to none at the present time. As a farmer's tree it is also not one of the worst; for although the branches incline to spread, still, by careful manipulation in the way of pruning, this may be corrected without to too great an extent doing injury to the ornamental qualities of the tree. As regards choice of soil, the sycamore is not fastidious, thriving well in that of very opposite qualities if not overcharged with moisture. The timber is clean, firm, fine-grained, susceptible of a high polish, and easily worked, qualities which specially recommend it for the use of the turner, sculptor, and cabinet-maker. At the present time, perhaps, no home-grown wood is more in request than the sycamore; indeed, the supply, at least in England and Wales, is quite inadequate for the demand. From carefully made observations, I am now fully convinced that no hedgerow or field tree repays so fully the damage it occasions to fences and the surrounding ground as the sycamore. When grown singly this tree, unlike most others, is not inclined to produce rambling and weighty side branches, but usually throws its full vigour or energy to the production of timber; and this being marketable, even when in a comparatively young state, still further enhances the value of the tree. As an example of the present value of single grown trees of the sycamore, I may state that but re-

cently since we felled on one farm fifty of these trees, which together realised close on £100. Neither must this be considered an exceptional case, for sums varying from £50 to £70 have frequently been received for the same number and class of timber produced on hedge banks or in field corners, and without in any way marring the landscape, but, I might add, with considerable benefit to the remaining trees. No other tree with which I am acquainted would, when placed under similar circumstances, have been equally remunerative, and at the same time occasioned less damage to its surroundings.

The hornbeam (*Carpinus Betulus*), for exposed situations and poor soils, has few, if any, equal in the whole range of forest trees ; and although the timber is only of second or third-rate quality, still its thriving on poor soils and in cold, bleak situations renders the tree of particular value to the mountain farmer. Even on cold clays, where few other hardwoods could exist, and at high elevations, the hornbeam seems quite at home, and attains large dimensions.

The roots do not run near the surface, but, like those of the oak, derive sustenance at a considerable distance from the surface, which, combined with its somewhat upright inclination of growth and hardy nature, renders it well adapted for hedgerow or field planting where shelter combined with effect is required. For ordinary purposes—such as handles for tools, wheel-wright's work, and, until glazed earthenware supplanted it, in the manufacture of milk vessels—the wood of the hornbeam, which is clean, white, and remarkably hard and durable, is in request.

The lime (*Tilia Europæa*), although one of our most ornamental trees, can hardly be recommended as suitable for situations in which the underlying herbage is at stake. For this latter reason alone, however, can it be omitted from our list, and as it bears pruning well, and does not to any great extent impoverish the adjoining ground, and is at all times a pleasing object in the landscape, it will be seen that the evil done by shade is, in a great degree, compensated for. The elegant form of the lime, combined with its luxuriant foliage and sweet blossoms, renders it a conspicuous object wherever planted, but more particularly when placed singly in well-chosen spots on the green sward. It is usually of a pyramidal or cone shape in outline, remarkably symmetrical, and in winter when denuded of its foliage has a peculiarly pleasing appearance that is quite its own. The roots do

not in full grown trees spread to a greater distance than from 10 ft. to 12 ft., while the main tap-root descends to 5 ft. or 6 ft., thus not to an unusual extent poverising the soil in its immediate vicinity. For several purposes lime wood is much in request, such as for "bottoming" carts, in the making of waggon breaks, packing-boxes, saddlers' and shoemakers' cutting boards, and, most important of all, for carving, it for this latter purpose being excelled by no other home-grown timber.

It bears trimming and pruning well, the lower stem-branches being removable without in any way injuring the tree's health, or, if carefully performed, marring its beauty. Grown as a hedgerow or field tree, the lime will require to have all suckers removed from its base, these soon forming a dense jungle of underwood if not attended to, and which considerably detract from the tree's appearance, as well as draw stores of food which would be more profitably deposited elsewhere.

Amongst coniferous trees there are few suitable for the end in question if we except the larch and Scots fir. The larch as an ornamental tree is, however, much neglected, this being attributable to an erroneous impression that the tree is of too stiff and cold an appearance either for standing singly or giving effect to the landscape. Nothing can, however, be more averse to facts, as, when placed so that its fine form is seen to advantage, few deciduous trees are more picturesque than the larch, or offer a better contrast to the ordinary run of our forest trees. It also occasions less damage to the undergrowing herbage than most trees, while, at the same time, it enriches the soil to a great extent by the annual shedding of its leaves. As regards value of timber produced it would be superfluous for us to speak, while as a hardy tree that thrives under a variety of circumstances it can compete favourably with most others.

The Scots fir, whether viewed in a useful or ornamental capacity, has much to recommend it for extensive planting, more particularly in high-lying and exposed situations. When judiciously placed no tree is more picturesque than the Scots fir, while few are better adapted for producing shelter, or more suitable for planting singly or in clumps where from exposure few other trees would succeed. As a hedgerow or field tree the Scots fir is not to be despised; indeed for planting in the exposed corners of fields that are to be met with on most farms no tree is, perhaps, better adapted. As it usually rises to a great height without branches, it cannot be con-

sidered as extremely injurious to its surroundings, although the shallow-running roots can hardly be spoken of as being non-injurious to the green sward.

Planting and Fencing.—Whether for planting in the hedgerow or singly in the fields, good, strong, well-rooted specimens should always be used; indeed it is well, where a home nursery is on the estate, to have these specially prepared by frequent transplantings for a few years previous to their final despatch. The nursery management will require both care and experience, so that trees with strong, fibrous roots equally distributed around the stem may be produced—lanky, ill-grown, and ill-rooted plants having but a poor chance of succeeding under the circumstances. From 6 ft. to 10 ft. in height will be found the most suitable size for the purpose under consideration. The pits for their reception should be opened of sufficient size so as to admit the roots without cramping or bending, the bottom and sides being made loose and free with a pick. All the better if the pits have been opened for some time previous to planting, the winter frosts having a beneficial effect in pulverising the soil. This is, however, seldom convenient, as, if in the field, they become filled in and trampled on by cattle, while gaps in the fences occasioned by these cannot well remain open for any length of time. The better plan, at least we have found it so, is to open the pits, plant the trees, and have these fenced in on the same day, as by this method the work has never to be done a second time, everything being finished up as the work proceeds. In planting be careful to spread the roots out in an even manner around the stem, as by so doing the tree is not only more firmly fixed in the ground, but is also enabled to collect food from all quarters.

Fencing.—This should follow up at once the work of planting, as, if the young trees are allowed to remain unprotected for any length of time, cattle and ground game not unfrequently cause damage from which it takes the young plant years to recover. Hedgerow trees under certain circumstances may not require fencing further than the placing of a few of the previously removed thorns around their stems, this being often as effective, more particularly where the fences are of the old-fashioned type and placed on a mound, as the best made tree guards. Where, however, the fences are of the modern type, it is always preferable to have wooden erections placed around the trees at time of planting. These guards may be of any desired shape, that commonly in use being either circular or square, the former being preferable. They

are simple of erection, being made of small larch poles of not less than 8 ft. in height, driven into the ground in a circle around the tree, and at a distance of say 18 in. from it. Near the top they are fastened by nails to a hoop of pliable wood, or, as is the case here, interlaced and firmly united by strong fencing wire. Wooden erections are, perhaps, preferable to iron hurdles for fencing in hedgerow trees, as they seldom require renewing, for by the time the fence has decayed the trees will, in most cases, be out of harm's way. Park or field trees may with advantage, and where fancy so points out, be guarded from the depredations of horses, cows, and sheep by any of the iron hurdles now commonly in use for this purpose, but where first expense is looked at, a wooden erection, but of better material and more neatly finished than that last described, will answer the purpose equally as well.

Pruning and After-Management.—For at least the first twenty years after planting, careful and regular pruning of hedgerow and field timber should in all cases be attended to, bearing in mind that timely attention in this way will alone obviate the necessity for heavy prunings at any future stage of the tree's growth. On early and judicious pruning to the classes of timber in question also, to a greater extent, depends whether or not damage is caused by these to their surroundings ; for it is well known that if branches are allowed to ramify at will, greater injury to the underlying herbage must be committed than where timely pruning and shortening of all straggling branches has been attended to. Early summer pruning—say in the month of June—is to be recommended, as at that time, owing to the active circulation of the sap, the wounds heal up much quicker than when the operation is performed at any other season of the year. The pruning should be performed by a person who is thoroughly conversant with the work, haphazard cutting and hewing by an inexperienced hand, and at any season, being most injurious. If the young trees have been well cared for whilst in the nursery border, little or no attention will be required for at least three years from the time of planting out ; but after that date they should be looked over every second or third year until an age of say twenty years are attained, after which they may have their course, but a good deal will, of course, depend on the particular species of tree operated upon. As the great object in pruning both hedgerow and field trees is to develop a valuable main stem, which is only to diverge into branches at a given height from the ground, and to prevent the overgrowth of straggling

branches further up so as to maintain a symmetrical outline, therefore let all endeavours be directed towards the furtherance of these ends. First, then, in training young trees to a stem let it be done gradually, year by year, until the intended height is attained, which, for the object under consideration, will be from 8 ft. to 12 ft.; but on no account adopt the too oft-repeated method of cutting away all the lateral branches at once, for this is not only highly injurious to the young tree, but very unsightly as well.

In removing the lower branches, cut these off at once close to the stem, and the results will be far more satisfactory than when the ruinous system of snag-pruning is resorted to; and in doing so let the work go on gradually, say tier by tier each season, until the desired number is removed, which will give those further up the chance of becoming sufficiently numerous to bear the loss of the lower ones with impunity. All rampant or side branches should also be foreshortened by cutting back to some of the smaller branches, at the same time endeavouring to show as little appearance of pruning as possible, but to balance the trees by producing an easy but rather fastigiate outline. Rival leaders should also be attended to,—the worst being removed, and a few of the top shoots cut back, so as to throw additional vigour into the remaining one. If the above method of pruning is carefully and regularly carried out for the first twenty years of the tree's growth, little or no attention will be required afterwards, and they will present not only a sightly appearance in the landscape, but be almost non-injurious to crops in their immediate vicinity.

The fences around each tree should also be carefully examined and repaired at least once each year, at the same time seeing that all stakes and ties are secure and serving the purpose for which they were intended.

L'EXPOSITION FORESTIÈRE INTERNATIONAL DE 1884.

Report by Professor Reuss, of the Nancy Forest School, on the Forestry Exhibition at Edinburgh in 1884.

It is with much pleasure that we solicit the attention of Scottish foresters, and the public in general, to a valuable Report by Professor Reuss, of the Nancy Forest School, on the International Forestry Exhibition, held at Edinburgh in 1884. Professor Reuss was deputed by the French Government to report on the Exhibition, and a large portion of his Report was published by it in the Minutes of the Agricultural Department, to which the forests are attached. As, however, the Report contains a great amount of matter highly interesting to foresters, but not expressly bearing on the Exhibition, and therefore not published in the Proceedings of the French Government, the Professor has determined to publish the Report *in extenso* at his own expense, hoping to recoup the cost of publication by its sale. It is now offered for sale at 3 frs. 73 cents, or 3s. British. The Report, which is perhaps the most comprehensive and detailed yet published on our Exhibition, covers 162 pages octavo, and is divided into four Chapters, besides an Introductory Preface, a Conclusion, and eight Appendices. There is also an excellent Index.

The Preface treats of the present condition of Forest science and management in Great Britain and its Colonies, the object of the Exhibition, the building itself, and the general arrangement of its contents.

Chapter I. is divided into three parts :—

Part 1 treats of the Crown forests of England, and the exhibits sent from them ; also of Kew Gardens, Epping Forest, and private forest properties and parks.

Part 2 treats of the forests in Scotland, both in the Highlands and Lowlands, which were personally visited by Professor Reuss on a former occasion ; also of the exhibits sent from them, as well as by the Scottish Arboricultural Society.

Part 3 refers to the forest literature of Scotland, and especially to the works on forestry by Dr Croumbie Brown.

Chapter II. refers to British India, its forests, forest service, and forest literature, as well as the exhibits sent from there.

CHAPTER III. is divided into four parts, and treats of the forests of the British Colonies :—

Part 1 refers to the exhibits from Sierra Leone, and the Gambia, the Cape of Good Hope, and the Mauritius.

Part 2 to the forests of Cyprus, Ceylon, Johore, and the Straits Settlements, and the exhibits therefrom.

Part 3 to the forests and exhibits from Australia, North Borneo, and Labuan.

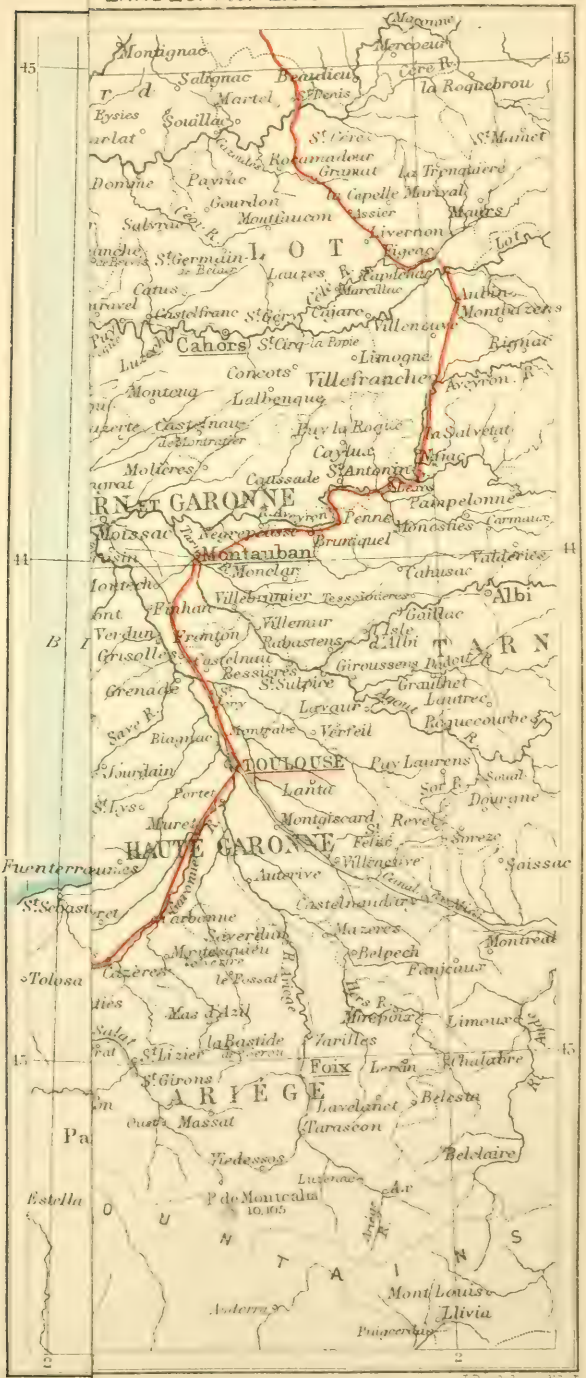
Part 4 to the exhibits from Canada, British Guiana, St Vincent, and Tobago.

CHAPTER IV.—This chapter contains a concise, but full account of the exhibits sent by foreign governments, viz. :—France, Germany, Denmark, Sweden and Norway, Italy, Switzerland, the United States of America, and Japan. The last country has had full justice done to it by the Professor, as indeed it deserved. It was most fully and effectively represented in the Exhibition by Messieurs Takei and Takasima ; and the pictures of forest scenery, forest maps, and illustrations of forest work, as well as the exhibits themselves, were highly instructive and interesting.

The Appendices contain :—1. A classified list of exhibits. 2. List of prizes offered for competition by the committee. 3. Statistics of the Forest of Dean. 4. List of forest works by Dr Croumbie Brown. 5. Statistics of growth of teak from the Nilambur plantations. 6. Method of preserving timber employed in Japan. 7. Forest school at Tokio (Japan). 8. Regulations concerning the Forest School of Japan.

We cannot commend too highly this most interesting and useful Report, not only to Scottish foresters, but to all who are interested in forestry everywhere. Scottish foresters, however, may be well proud of the minute attention and careful criticism bestowed on their Exhibition by the learned Professor, who has truly recognised the merit of this attempt on their part to bring to the serious notice of a public only too prone "to pass by on the other side," and neglect it, a science so important to the development of the great natural forest riches of their country. Under the impression that forests always grew somehow of themselves, and that they will do so as long as the world lasts, people in general pay but little attention to the fact that civilisation, and the increase in the number of the world's inhabitants, has changed all these conditions of Nature ; and that in proportion as these conditions are more and more developed, so forests will more and more be swept away

from the earth's surface. The increased facilities of transport, and the creation of railways, have been perhaps the most important factor in this disappearance of forests. The Professor has not lost sight of this, and he vividly brings it out in his Report, which is marked, not only by the ability and care with which it is compiled, but by the kindly and sympathetic spirit which inspired it throughout. We trust that in return for this kindly interest which Professor Reuss has taken in our enterprise, his many well-wishers here will help him to recoup the necessary expense of the publication of his full Report by purchasing copies of his little work.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Assier
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LOT
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St Germain-le-Belair
Lauzes
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Marcillac
Anglars
Montdezert
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Cahors
St Cirq-la Popie
Limogne
Bagnac
Concots
Villefranche
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Montcuq
Lalbenque
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la Salvetat
Castelnau de Montratier
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St Antonin
Penne
Pampelonne
Monclar
Monestiés
Carmaux
Moissac
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Felix
Sorèze
HAUTE GARONNE
Fuenterrabia
Villeneuve
Saissac
St Sebastien
Auterive
Castelnaudary
Carbonne
Mazères
Montreal
Seyerdun
Belpech
Montesquieu
Fanjeaux
Tolosa
Cazères
le Fossat
Mirepoix
Limoux
Mas d'Azil
la Bastide de Sérou
Varilles
St Lizier
Foix
Leran
Chalabre
St Girons
ARIÉGE
Lavelanet
Belesta
Massat
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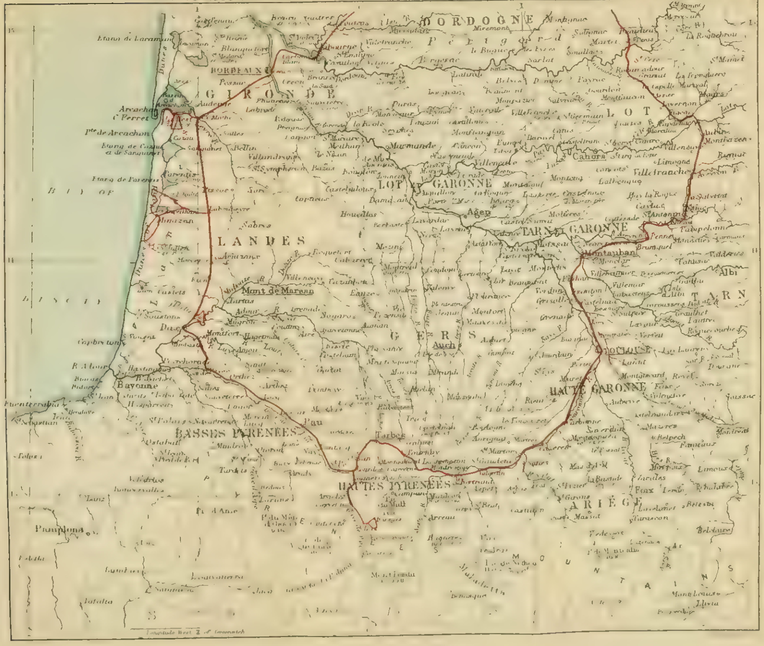
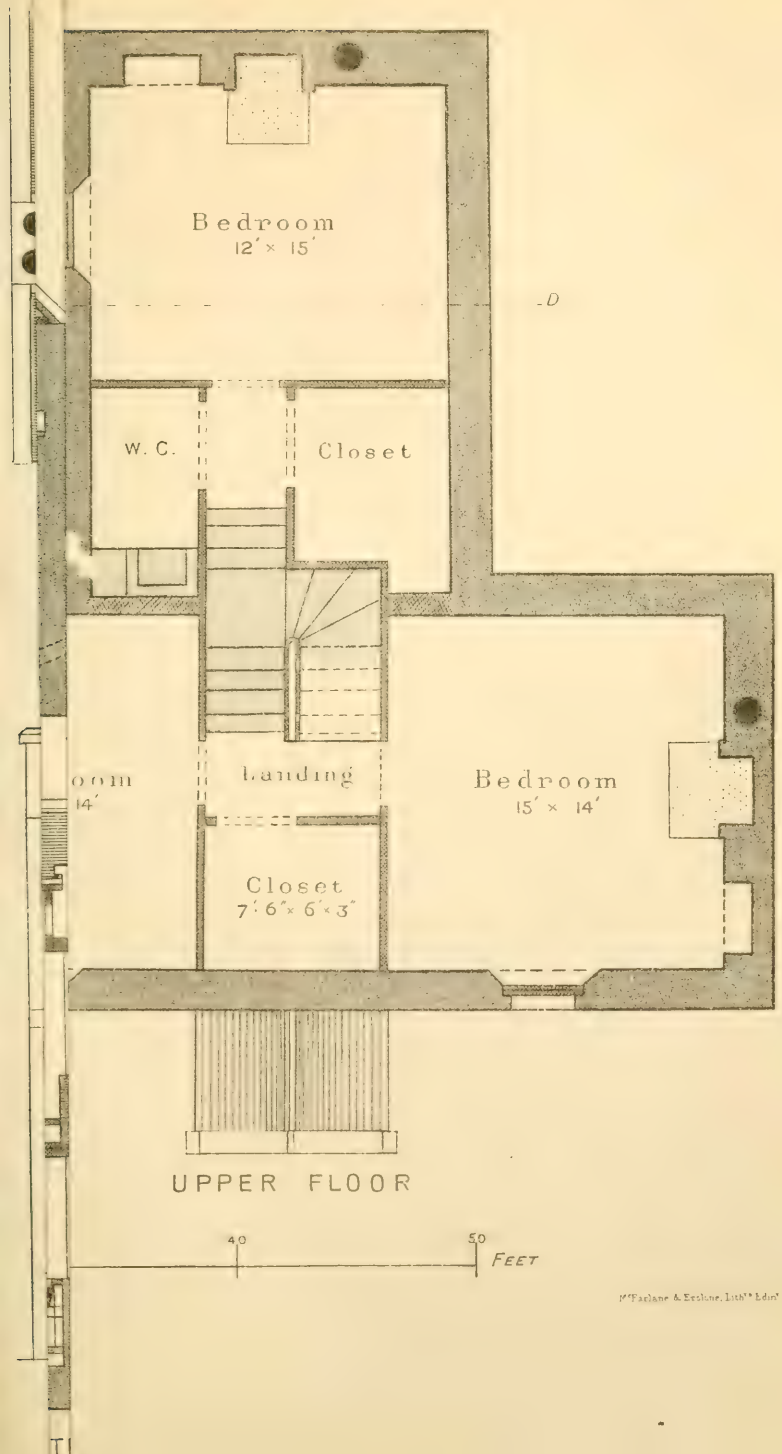
Pa
Bedeilhac
Tredesos
Estella
P de Montcalm 10,105
Mont Louis
Andorra
Llivia
Puigcerda
J. Bartholomew, Edin.

MAP TO ACCOMPANY ACCOUNT OF MAJOR BAILEY'S TOUR IN THE LANDES.

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Landing
Bedroom
15′ × 14′
Closet
7′ 6″ × 6′ × 3″
UPPER FLOOR
40
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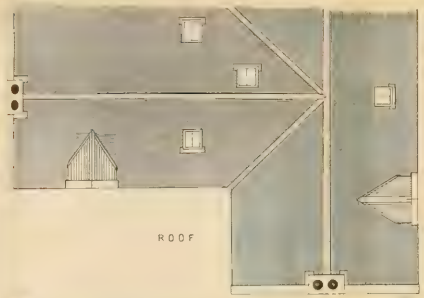
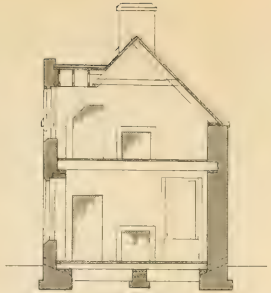
FEET
M'Farlane & Erskine, Lith.rs Edin.

PLAN OF FORESTER'S COTTAGE

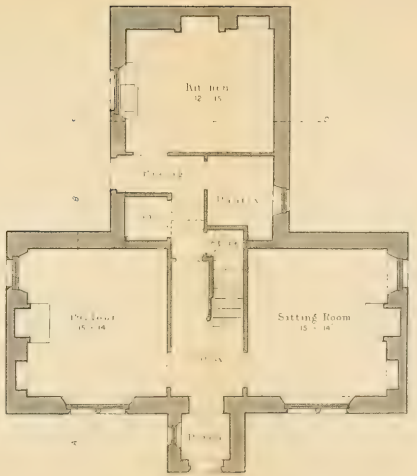
Sc. Arch. Soc. Trans. Vol. XI. Pl. XI



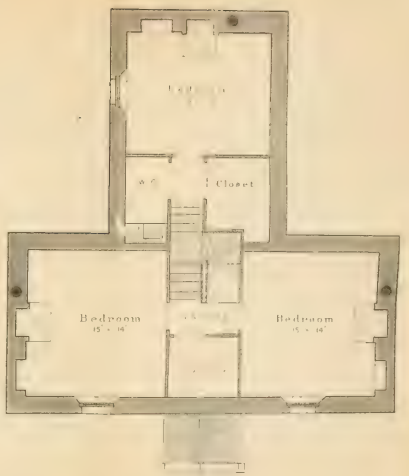
ROOF



SECTION A B

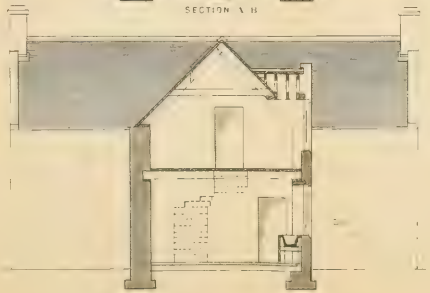


GROUND FLOOR.

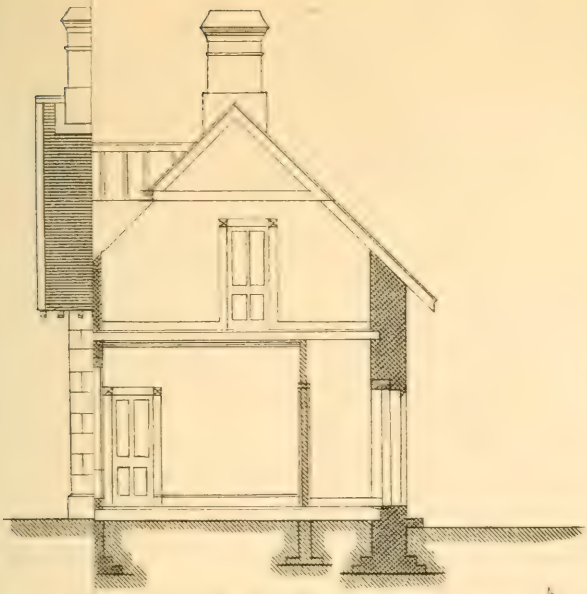


UPPER FLOOR

FRONT ELEVATION.



BACK ELEVATION AND SECTION.



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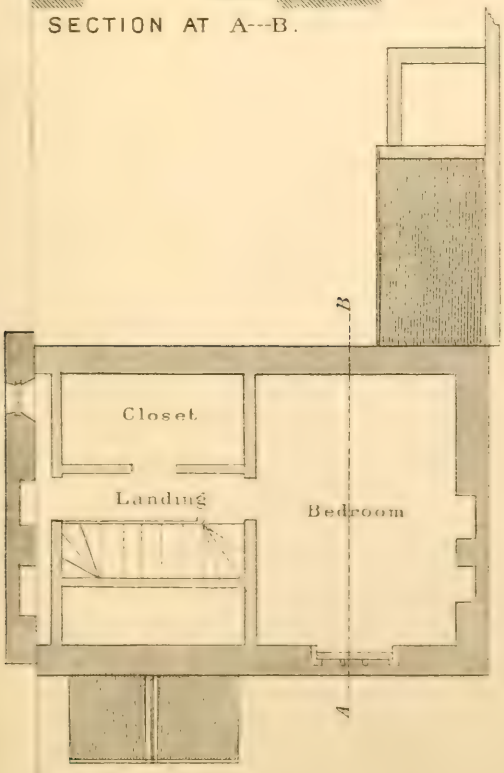


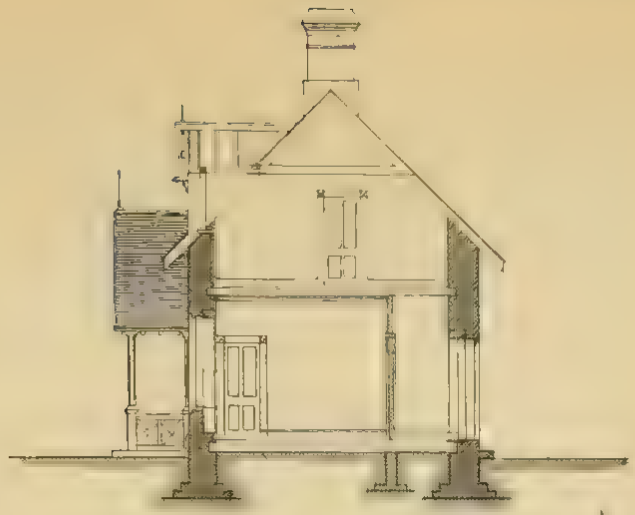
BEDROOM PLAN.

Drawn by A

Mc Farlane & Erskine, Lithrs Edinr

FORESTER'S COTTAGE

FRONT ELEVATION



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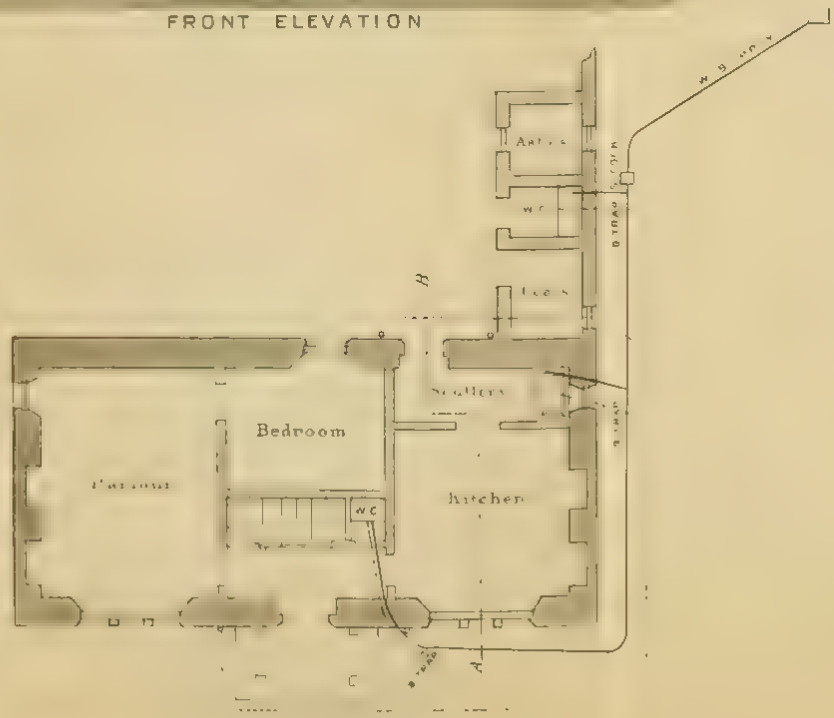
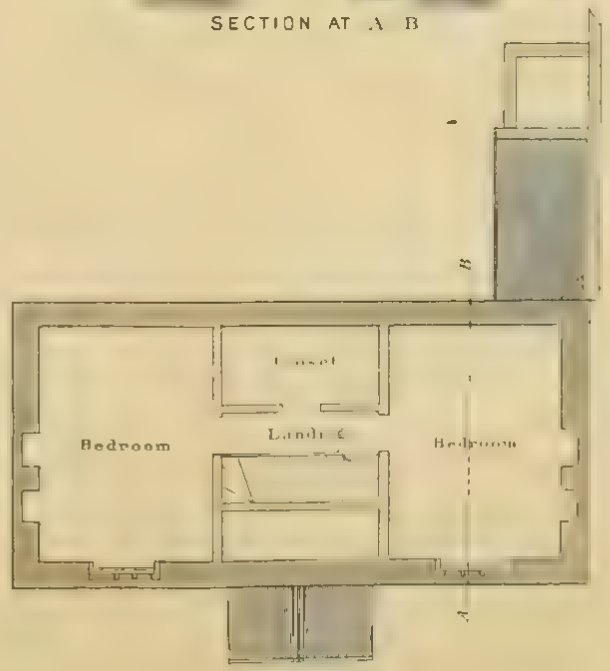


GROUND PLAN



BEDROOM PLAN.

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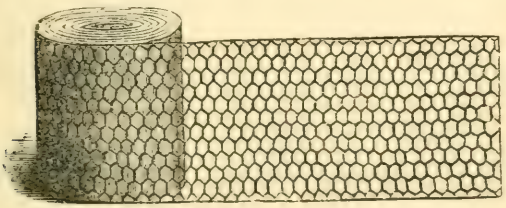

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EDINBURGH.

Printers to the Scottish Arboricultural Society, Royal Physical Society, etc

APPENDIX (A.)

Scottish Arboricultural Society.

PATRON—HER MOST GRACIOUS MAJESTY THE QUEEN.

1.—FORMER PRESIDENTS.

YEAR.		MEMBERS.
1854-55.	JAMES BROWN, Deputy-Surveyor of the Royal Forest of Dean,	35
1855-56.	Ditto, Wood Commissioner to the Earl of Seafield,	59
1856-57.	Ditto, ditto,	92
1857-58.	The Right Hon. THE EARL OF DUCIE,	142
1858-59.	The Right Hon. THE EARL OF STAIR,	167
1859-60.	Sir JOHN HALL, Bart., of Dunglass,	170
1860-61.	His Grace THE DUKE OF ATHOLE,	182
1861-62.	JOHN J. CHALMERS of Aldbar,	159
1862-63.	The Right Hon. THE EARL OF AIRLIE,	163
1863-64.	The Right Hon. T. F. KENNEDY,	151
1864-65.	ROBERT HUTCHISON of Carlowrie, F.R.S.E.,	162
1865-66.	Ditto, ditto,	168
1866-67.	Ditto, ditto,	220
1867-68.	Ditto, ditto,	284
1868-69.	Ditto, ditto,	367
1869-70.	Ditto, ditto,	464
1870-71.	Ditto, ditto,	549
1871-72.	Ditto, ditto,	612
1872-73.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie,	658
1873-74.	Ditto, ditto,	665
1874-75.	JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS.L. & E., Professor of Botany in the University of Edinburgh,	681
1875-76.	Ditto, ditto,	698
1876-77.	The Right Hon. W. P. ADAM of Blairadam, M.P.,	731
1877-78.	Ditto, ditto,	750
1878-79.	Ditto, ditto,	730
1879-80.	The Most Hon. THE MARQUIS OF LOTHIAN, K.T.,	732
1880-81.	Ditto, ditto,	740
1881-82.	Ditto, ditto,	745
1882-83.	ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh,	693
1883-84.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie,	756
1884-85.	Ditto, ditto,	772

2.—LIST OF MEMBERS.

Corrected to July 1885.

The Names of Members whose present Address is not known to the Secretary are printed in italics.

Law V. Members in arrear shall not receive the *Transactions* while their Subscriptions remain unpaid. Any Member whose Annual Subscription to the Society remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till he shall have paid up his arrears.

Date of Election.

HONORARY MEMBERS.

1873. Brandis, Dietrich, Ph.D., *Ex*-Inspector-General of Forests in India, Bonn, Germany.
1868. Bullen, Robert, Curator of the Botanic Garden, Glasgow.
1864. Hutchison, Robert, F.R.S.E., of Carlowrie, 29 Chester St., Edinburgh.
1856. Lawson, George, LL.D., Ph.D., Professor of Natural History and Chemistry, Dalhousie College, Halifax, Nova Scotia.
1854. M'Corquodale, William, Forester and Wood Surveyor, Jeanie Bank, Perth (also a *Life* Member by composition).
1881. Temple, Sir Richard, Bart., G.C.S.I., The Nash, Worcestershire.

LIFE MEMBERS.

1875. Acland, Sir Thomas Dyke, Bart., M.P., of Killerton, Exeter.
1883. Adam, Sir Charles Elphinstone, Bart. of Blair Adam, Kinross-shire.
1883. Alexander, John, Kirklees, Uda Pusalawa, Ceylon.
1883. Athole, His Grace the Duke of, K.T., Blair Castle, Blair Athole.
1884. Balfour of Burleigh, The Right Hon. Lord, Kennet House, Alloa.
1870. Barbour, George F., of Bonskeid, Pitlochrie, Perthshire.
1866. Barrie, James, Forester, Stevenstone, Torrington, North Devon.
1884. Bates, Cadwallader John, of Heddon and Langley Castle, Northumberland.
1871. Bell, William, of Gribdae, Kirkcudbright.
1875. Bertram, William, Ellengowan Villa, Newington, Edinburgh.
1877. Bolckow, C. F. H., of Brackenhoe, Middlesboro'-on-Tees.
1881. Brodie of Brodie, Brodie Castle, Forres.
1882. Bruce, Hon. Robert Preston, M.P., Broomhall, Dunfermline.
1871. Bruce, Hon. T. C., 24 Hill Street, Berkeley Square, London, W.
1867. Bruce, Thomas Rae, of Slogarie, New Galloway Station.
1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Park, Dalkeith.
1877. Clay, J. Spender, Ford Manor, Lingfield, Surrey.

Date of Election.

1865. Cleghorn, Hugh, M.D., F.R.S.E., of Stravithie, St Andrews, Fife.
1872. Clerk, Sir George D., Bart., Penicuik House, Penicuik.
1876. Cowan, Charles W., younger of Logan House, Valleyfield, Penicuik.
1875. Craig, William, M.D., C.M., F.R.S.E., 7 Lothian Road, Edinburgh.
1865. Crawford, William Stirling, of Milton, Glasgow.
1865. Cross, David G., Forester, Kylisk, Nenagh, Ireland.
1880. Cumberbatch, L. H., Holt Cottage, Brockenhurst, Hants.
1880. Curr, Henry, Factor, Pitkellony House, Muthill, Perthshire.
1884. Currie, Sir Donald, K.C.M.G., M.P., of Garth Castle, 13 Hyde Park Place, London, W.
1867. Dalgleish, John J., of Ardnamurchan, 8 Athole Crescent, Edinburgh.
1876. Dalgleish, Laurence, of Dalbeath, 8 Athole Crescent, Edinburgh.
1882. Dalhousie, The Right Hon. The Earl of, K.T., Brechin Castle, Brechin.
1877. Dewar, Daniel, Forester, Beaufort Castle, Beauly.
1871. Duncan, Alexander, of Knossington Grange, Oakham, Leicestershire.
1875. Duncan, James, of Benmore, Kilmun, Greenock.
1883. Dundas, Charles H., of Dunira, Dalhonzie, Crieff.
1872. Dundas, Robert, of Arniston, Gorebridge.
1875. Eastwood, James, The Gardens, Bryn-y-Newadd, Bangor, North Wales.
1876. Edwards, William Peacock, S.S.C., 21 Hill Street, Edinburgh.
1881. Elliot, Walter, Manager, Ardtornish, Morven, Oban.
1869. Fish, D. T., Hardwick House, Bury St Edmunds.
1874. Fitzwilliam, The Right Hon. the Earl, K.G., Wentworth, Rotherham, Yorkshire.
1881. Forbes, Arthur Drummond, Millearne, Auchterarder, Perthshire.
1866. France, Charles S., Factor to the Earl of Mansfield, Scone, Perth.
1856. Gough, William, Wood Manager, Wykeham, York.
1884. Graham, Wm., of Erins, Tarbert, Lochfyne.
1880. Grant, Sir George Macpherson, Bart., M.P., Ballindalloch Castle, Banffshire.
1874. Grant, John, Overseer, Daldowie, Tollcross.
1867. Grimond, Alexander D., of Glenericht, Blairgowrie.
1880. Hare, Colonel, Philpstoun House, Winchburgh.
1874. Herbert, H. A., of Muckross, Killarney.
1884. Heywood, Arthur, Sudbourne Hall, Wickham Market, Suffolk.
1871. Hope, H. W., of Luffness, Drem.
. Horne, John, Director, Forests and Gardens, Mauritius, per Messrs Richardson & Co., 13 Pall Mall, London, W.C.
1876. Horsburgh, John, Photographist and Portrait Painter, 131 Princes Street, Edinburgh.
1874. Hubbard, Egerton, M.P., of Addington Manor, Winslow, Bucks.
1869. Huth, Louis, of Possingworth, Hawkhurst, Sussex.
. Hutton, James, Bankfoot, Perth.
1884. Inglis, Alex., Breadalbane Estate Office, Aberfeldy.
1866. Jeffrey, John, of Balsusney, Kirkcaldy, Fife.
1880. Jenner, Charles, Easter Duddingston Lodge, Edinburgh.
1882. Jonas, Henry, Land Agent and Surveyor, 4 Whitehall, London, S.W.
1876. Leicester, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.

Date of Election.

1868. Leslie, Charles P., of Castle-Leslie, Glasslough, Ireland.
1874. Leslie, The Hon. George Waldegrave, Leslie House, Leslie, Fife.
1883. Loney, Peter, Estate Agent, Marchmont, Duns.
1881. Lonsdale, Claud, Rose Hill, Carlisle.
1869. Lothian, The Most Hon. the Marquis of, K.T., Newbattle Abbey, Dalkeith.
1880. Lovat, The Right Hon. Lord, Beaufort Castle, Beauly.
1880. Love, J. W., care of Mrs J. Boyce, Semaphore, Lefevre's Peninsula, South Australia.
1875. Lovelace, The Right Hon. the Earl of, East Horsley Towers, Woking Station, Surrey.
1881. Lumsden, David, of Pitcairnfield, Perth.
1875. Luttrell, George F., of Dunster Castle, Taunton, Somersetshire.
1874. Macdonald, Ranald, Factor, Cluny Castle, Aberdeenshire.
1876. M'Dougall, Captain J. W., jun., of Orchill, Braco, Perthshire.
1884. Macduff, Alex., of Bonhard, Perth.
1868. M'Gregor, John, Forester, Ladywell, Dunkeld, Perthshire.
1879. M'Intosh, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1882. M'Kenzie, Alex., Superintendent of Epping Forest, The Warren, Loughton, Essex.
1869. Mackenzie, Colin, J., of Portmore, Eddleston, Peebles.
1880. Mackenzie, Sir Kenneth, Bart., Conon House, Dingwall.
1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
1857. MacTier, A. W., "Rothesay," Bournemouth, Hants.
1880. Malcolm, Lieut.-Col. E. D., R.E., 18 Queen's Gate Place, London, S.W.
1871. Maxwell, Wellwood H., of Munches, Dalbeattie.
1880. Mesham, Captain, Pontryffydd, Bodvari, Rhyl.
1881. Michie, John, Forester, Balmoral, Ballater.
1858. Minto, The Right Hon. the Earl of, Minto House, Hawick.
1882. Mitchell, Francis, Forester, Warwick Castle, Warwick.
1871. Moore, Thomas, F.L.S., Curator, Botanic Garden, Chelsea.
1881. Naylor, Christopher John, Brynellywarch, Kerry, Montgomeryshire.
1883. Paton, Chalmers Izett, of Belstane, Kirknewton.
1856. Portsmouth, The Right Hon. the Earl of, Eggesford, North Devon.
1878. Punchard, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.
1855. Ramsden, Sir John, Bart., 6 Upper Brook Street, London, W.
1874. Ridley, G., 2 Charles Street, Berkeley Square, London, W.
1876. Ritchie, William, of Middleton, Gorebridge, Edinburgh.
1866. Robertson, James, Wood Manager, Panmure, Carnoustie.
1883. Rollo, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
1872. Rosebery, The Right Hon. the Earl of, Dalmeny Park, Edinburgh.
1871. Rosslyn, The Right Hon. the Earl of, Dysart House, Fife.
1854. Rutherford, James, Agent, Kirkleatham, Redcar, Yorkshire.
1877. Smith, Thomas Valentine, of Ardtornish, Morvern, Argyleshire (111 Grosvenor Road, London, S.W.).

Date of Election.

1882. Smythe, David M., yr. of Methven Castle, Perth.
1883. Sprot, Captain Alexander, of Garnkirk.
1883. Stafford, The Most Hon. the Marquis of, M.P., Dunrobin Castle, Golspie.
1873. Stair, The Right Hon. the Earl of, Lochinch, Castle Kennedy, Wigtownshire.
1883. Stormont, The Right Hon. Viscount, Scone Palace, Perth.
1880. Sutherland, Evan C., of Skibo Castle, Dornoch.
1865. Talbert, Peter, Forester, Glenericht, Blairgowrie.
1877. Terris, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1880. Thomson, Alexander, 35 Chester Street, Edinburgh.
1855. Thomson, John Grant, Wood Manager, Grantown, Strathspey.
1872. Trotter, Colonel, R.A., The Bush, Edinburgh.
1878. Turnbull, John, of Abbey St Bathans, 49 George Square, Edinburgh.
1872. Urquhart, B. C., of Meldrum, Aberdeenshire.
1878. Walker, Major I. Campbell, Conservator of Forests, Forest Office, Madras.
1872. Waveney, Lord, Flixton Hall, Bungay, Suffolk.
1882. Webster, Thomas, Timber Merchant, South Terrace Saw Mills, Hunslet Lane, Leeds.
1872. Wemyss, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
1869. Wild, Albert Edward, Conservator of Forests, Punjab, India (care of W. Wild, Wath-upon-Dearne, Rotherham, Yorkshire).
1861. Wilson, John, F.R.S.E., Professor of Agriculture, University, Edinburgh.

ORDINARY MEMBERS.

1882. Ahlbottn, Nathaniel, Oil and Colour Manufacturer, 50 Shore, Leith.
1856. Airlie, The Right Hon. the Earl of, Cortachy Castle, Forfarshire.
1878. Aitken, Andrew Peebles, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.
1872. Alexander, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1883. Allan, Alex., Forester, Mitchelstown Castle, County Cork.
1865. Allan, John, Forester, Dalmeny Park, Edinburgh.
1882. Allan, Thomas G., Ironmonger, Helensburgh.
1869. Anderson, Alexander, Forester, St Fort, Newport, Dundee.
1869. Anderson, Alexander, Gardener, Musselburgh.
1883. Anderson, David, Assistant Forester, Inver, Dunkeld.
1880. Anderson, George, Timber Merchant, Bonar Bridge.
1883. Anderson, Hector, Assistant Forester, Ardross, Alness, Ross-shire.
1883. Anderson, James, Forester, Early Wood, Bagshot, Surrey.
1881. Anderson, Peter, Forester, Dupplin Castle, Perth.
1881. Anderson, Thomas R., Assistant Forester, Idvies, Forfar.
1872. Annandale, Robert B., Adderley Lodge, Market Drayton, Shropshire.
1871. Archer, James, Forester, Woodstock, Inistiogue, County Kilkenny.
1867. Archibald, Thomas, Forester, Monkwray, Whitehaven, Cumberland.
1883. Argyll, His Grace the Duke of, K.T., LL.D., D.C.L., F.R.S., F.G.S., Inveraray Castle, Argyleshire.
1860. Austin & M'Aslan, Nurserymen and Seedsmen, Buchanan St., Glasgow.

Date of Election.

1877. Bain, W. P. C., Lochrin Ironworks, Lower Gilmore Place, Edinburgh.
1880. Baines, W. M., of Bell Hall, York.
1880. Balden, John, Dilston, Corbridge-on-Tyne, Northumberland.
1880. Balden, Robert S., Wood Manager, Castle Howard, York.
1877. Balfour, Isaac Bayley, Sc.D., M.D., F.L.S., Professor of Botany, Oxford.
1877. Barclay, David, Forester, Routenburn, Largs, Ayrshire.
1884. Barrett, Robert Bell, Estate Agent, Skipton Castle, Skipton, Yorkshire.
1867. Barrie, David, Forester, Comlongan Castle, Annan.
1882. Barrie, John, Land Steward, Gateforth Hall, Selby, Yorkshire.
1877. Barry, John W., of Park Hill, 1 Duncombe Place, York.
1874. Barton, James, Forester, Hatfield House, Herts.
1879. Bates, Rev. John E. E., Milbourne Hall, Northumberland.
1871. Baxter, Robert, Forester, Dalkeith Park, Dalkeith.
1858. Baxter, William, Forester, Dunrobin, Golspie.
1870. Bayne, Lewis, Forester, Kinmel Park, Abergele, North Wales.
1878. Bell, Andrew, Assistant Forester, Yester, Haddington.
1883. Bell, Andrew, Assistant Forester, Wemyss Castle, Dysart.
1866. Bell, James, The Gardens, Stratfieldsaye, Winchfield, Hants.
1884. Bell, Robert, The Gardens, Morton Hall, Liberton, Edinburgh.
1884. Bett, Thomas, Factor, Portbane, Kenmore, Aberfeldy.
1869. Birch, John, The Gardens, Windlestone Hall, Ferry Hill, Durham.
1876. Bisset, Alexander, Manager, Balfarg, Markinch, Fife.
1869. Bissett, William S., Overseer, Moncrieffe House, Perth.
1883. Blake, Jas., Assistant Forester, Morton Hall, Edinburgh.
1869. Boa, Andrew, Land Steward, Dalton House, Newcastle-on-Tyne.
1872. Boa, Andrew, jun., Sub-Agent, Great Thurlow, Newmarket, Suffolk.
1876. Booth, John, of Flottbeck Nurseries, Hamburg.
1857. Borthwick, William, Forester, Dunnichen, Forfar.
1882. Boss, John, Jun., Assistant Forester, Hopetoun, South Queensferry.
1883. Boyd, John, Assistant Forester, Kilmahew, Cardross.
1860. Brodie, James, Land Steward, Glasslough, Armagh, Ireland.
1880. Brodie, Thomas D., W.S., 5 Thistle Street, Edinburgh.
1881. Brodie, Vernon Alex., Civil Service, Madras.
1880. Brotherston, R. P., The Gardens, Tyninghame, Prestonkirk.
1874. Brown, Andrew, Assistant Forester, Portmore, Eddleston.
1879. *Brown, George E., Forester, Cumloden, Newton-Stewart.*
1878. Brown, J. A. Harvie, of Quarter, Dunipace House, Larbert.
1868. Brown, John E., F.L.S., Conservator of Forests, Forest Board Office, Adelaide, S.A.
1878. Brown, Robert, Forester, Blackwood, Lesmahagow.
1884. Brown, Thomas, Forester, Craigingillan, Dalmellington.
1883. Browning, John, The Gardens, Dupplin Castle, Perth.
1870. Bryan, F. G. D., Factor, Drumpellier, Coatbridge.
1873. Brydon, John, Forester, Rothes, Elgin.
1873. Buchan, Alexander, A.M., F.R.S.E., Secretary of the Scottish Meteorological Society, 72 Northumberland Street, Edinburgh.

Date of Election.

1877. Buchan, William, Forester, Grangemuir, Pittenweem, Fife.
1879. Buchanan, Charles, Overseer, Penicuik House, Penicuik.
1865. Buchanan, Robert R., Forester, Duns Castle, Duns.
1880. Buddicom, W. B., Penbedw, Mold, Flintshire.
1875. Burgess, William, Forester, Drumpellier, Coatbridge.
1884. Burrows, Alfred J., F.S.I., F.L.S., Land Steward, Pluckley, Kent.

1870. Cameron, Alexander, Forester, Countlich Lodge, Ballinluig, Perthshire.
1881. *Cameron, Alex., Assistant Forester, Gask, Perth.*
1876. *Cameron, Donald, 9 Canon Street, Canonmills, Edinburgh.*
1879. *Cameron, H. W., Forester, Roschaugh, Killen, Ross-shire.*
1881. *Cameron, Joseph, Assistant Forester, Roschaugh, Killen, Ross-shire.*
1866. Cameron, Robert, Forester, Pale, Corwen, North Wales.
1867. Campbell, Alexander, Forester, Old Manse, Liff, Dundee.
1882. Campbell, Alex., Assistant Forester, Murthly, Perthshire.
1865. Campbell, James, of Tillichewan Castle, Dumbartonshire.
1868. Campbell, John, Forester, Aboyne Castle, Aberdeenshire.
1883. Campbell, John M., Assistant Curator, City Museum, Kelvingrove Park, Glasgow.
1878. Cantley, N., Superintendent, Botanical Gardens, Straits Settlements.
1870. Chaplain, George, Assistant Forester, Glamis Castle, Forfarshire.
1877. Chapman, Frederick, Overseer, Wansford, Peterborough.
1867. Chirnside, Francis, Forester, Ladykirk, Berwickshire.
1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1884. Christie, Alex. D., The Gardens, Warwick Castle, Warwickshire.
1883. Christie, William, Nurseryman, Fochabers.
1871. Churnside, Robert, Forester, Edlingham, Alnwick.
1872. Clark, David, Forester, Elie House, Elie, Fife.
1866. Clark, James, Forester, Balvaird Cottage, Strathmiglo, Fife.
1867. Clark, John, Ground Officer, Keith Hall, Aberdeenshire.
1867. Clark, John, Forester, Kelly, Wemyss Bay.
1882. *Clark, Wm., Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.*
1870. Cobban, John, Wood Agent, Wentworth Woods, Rotherham, Yorks.
1869. Cockburn, William, Forester, Willowbank, Penicuik.
1867. Cocker, James, The Nurseries, Sunnypark, Aberdeen.
1882. Collins, Robt. T., Forester, Trentham, Stoke-on-Trent, Staffordshire.
1879. Colquhoun, Andrew, Forester, Rossdhu, Luss, Dumbartonshire.
1877. Colquhoun, William, of Rossdhu, Luss, Dumbartonshire.
1869. Corbett, James, Forester, Underley Hall, Kirkby Lonsdale, Westmoreland.
1877. Corbett, John, Forester, Dallam Tower, Milnthorpe, Westmoreland.
1876. Coupar, George, 24 St Andrew Square, Edinburgh.
1879. Coupar, Robert, Forester, Ashford, Cong, County Galway.
1858. Cowan, James, Forester, Bridgend, Islay.
1872. Cowie, John, Assistant Forester, Mountstuart, Rothesay.
1874. Cowper, R. W., Assistant Agent, 81 High Street, Sittingbourne.
1875. Crabbe, David, Forester, Cortachy Castle, Kirriemuir.
1867. Crabbe, James, Forester, Glamis Castle, Forfarshire.

Date of Election.

1880. Crawhall, George, Burton Croft, York.
1882. Crearer, John, Assistant Forester, Scone, Perth.
1876. Cromb, James, Assistant Forester, Kelly Castle, Arbirlot, Arbroath.
1873. Crosbie, John, Forester, Ballindalloch Castle, Banffshire.
1873. Cumming, Donald, Lynwilg Hotel, Aviemore, Inverness-shire.
1884. Cumming, John, Assistant Forester, Keith Hall, Aberdeenshire.
1883. Cunningham, Alex., Assistant Forester, Ardross, Alness, Ross-shire.
1881. Cunninghame, J. C., of Craigends, Johnstone, Renfrewshire.
1868. Cunningham, John, Forester, Ardross, Alness, Ross-shire.
1882. Cunningham, Robt., Estate Office, Hirsel, Coldstream.
1880. Curr, James, Factor, Empingham, Stamford.

1884. Dalziel, James, Forester, Culzean Castle, Maybole, Ayrshire.
1869. Daniels, Peter, Forester, Slindon Hall, Arundel, Sussex.
1884. Davidson, Alex., Assistant Forester, Durris, Aberdeen.
1874. Davidson, George, Land Steward, Carriden, Linlithgow.
1883. Davidson, James, Assistant Forester, Cavers, Hawick.
1865. Davidson, John, Land Agent, Greenwich Hospital Estates, Haydon Bridge, Northumberland.
1857. Davidson, John, Forester, Aldbar, Brechin.
1884. Deane-Drake, Joseph Edward, Stokestown House, New Ross, Ireland.
1883. Denne, John, Jun., Greenstreet, Sittingbourne, Kent.
1877. Dewar, John, Assistant Forester, Altyre, Forres.
1882. Dick, Archd., Assistant Forester, Hopetoun, South Queensferry.
1883. Dickie, James, Gardener, Curraghmore, Portlaw, Waterford.
1879. Dickson, Alex., M.D., F.R.S.E., of Hartree, Professor of Botany in University of Edinburgh (11 Royal Circus).
1884. Dickson, A., Steward, Baron's Court, Tyrone, Ireland.
1870. Dickson & Sons, James, Newton Nurseries, Chester.
1858. Dickson & Sons, James, Nurserymen and Seedsmen, 32 Hanover Street, Edinburgh.
1854. Dickson & Turnbull, Nurserymen and Seedsmen, Perth.
1868. Dodds, George, Overseer, Wyreside Cottage, Lancaster.
1877. Doig, Charles, Overseer, Glen Tulchan, Methven, Perth.
1880. *Doragh, Andrew, Foreman, The Gardens, Knockmaroon Lodge, Chapelizod, Dublin.*
1882. Douglas, Captain Palmer, of Cavers, Hawick.
1884. Doughty, Wm., Forester, Langholm Estate, Canonbie, Dumfriesshire.
1867. Dow, Thomas, Overseer, Idvies, Forfar.
1862. Drummond & Sons, William, Nurserymen, Stirling.
1866. Duff, James, Factor, Blackwood, Lesmahagow.
1868. Duff, James, Freeland, Bridge of Earn, Perthshire.
1868. Duff, James, Wood Manager, Bells Yew Green, Tunbridge Wells, Kent.
1884. Dumphy, Edward, Timber Merchant, Inistiogue, Kilkenny.
1875. Duncan, James, Land Steward, Glack, Old Meldrum.
1862. Duncan, William, Forester, Ardgowan, Greenock.
1867. Dunn, Malcolm, The Palace Gardens, Dalkeith.

Date of Election.

1873. DURWARD, Robert, Manager, Blelack, Dinnet, Aberdeenshire.

1873. EDEN, The Hon. R. Henley, Minety House, Malmesbury, Wilts.
1884. EDEN, Henley, Agent to His Grace the Duke of Somerset, Bradley Estate Office, Maiden Bradley, Bath.
1876. EDWARD, John, Forester, Abercairney, Crieff.
1882. ELDER, Wm., Assistant Forester, Dundas Castle, Kirkliston, Edinburgh.
1878. ELLIOT, Sir Walter, K.C.S.I., F.R.S., Wolfelee, Hawick.
1877. ERSKINE, William, of Oaklands, Trinity.
1881. EWART, Andrew, Gardener, Moniack, Beauly.
1873. EWING, David, Forester, Strichen House, Aberdeen.

1879. FALCONER, Dr John, St Anns, Lasswade.
1884. FARQUHARSON, George, Assistant Forester, Durris, Aberdeen.
1869. FERGUSON, Alex., 21 Duddingston Park, Portobello.
1874. FERGUSON, John, Oakbank, Dollar.
1880. FERGUSSON, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1884. FERGUSON, Wm. Hooker, Knowefield Nurseries, Carlisle.
1872. FINGLAND, John, Forester, Drumlanrig, Thornhill, Dumfriesshire.
1879. FINLAY, Thos., Assistant Forester, Hopetoun House, South Queensferry.
1883. FINLAYSON, Robert, Assistant Forester, Hopetoun, South Queensferry.
1869. FISHER, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1876. FISKIN, Alexander, Assistant Forester, Rossdhu, Dumbartonshire.
1884. FLEMING, John, Camperdown Saw-Mills, Dundee.
1864. FORBES, Andrew, Forester, Stracathro, Brechin.
1884. FORBES, A. J., Clava School, Daviot, Inverness.
1882. FORBES, David, Assistant Forester, Darnaway Castle, Forres.
1884. FORBES, John, Buccleuch Nurseries, Hawick.
1878. FORBES, Robert, Forester, Jardine Hall, Lockerbie.
1873. FORBES, William, Stoneleigh Estate Office, Kenilworth, Warwickshire.
1869. FORGAN, James, Gardener and Overseer, Bonskeid, Pitlochrie.
1884. FORREST, Thomas, Assistant Forester, Allanton House, Newmains.
1883. FORREST, Sir William J., Bart. of Comiston, Edinburgh.
1883. FORRESTER, John, Architect, 37 Broughton Place, Edinburgh.
1878. FORSYTHE, John M., Wood Manager, Clifden Estates, Gowran, Co. Kilkenny.
1880. FOTHERINGHAM, Alex., Manager, Newholme, Dolphinton.
1884. FOULIS, Thomas, Publisher, 9 South Castle Street, Edinburgh.
1882. *Fowler, Alex., Assistant Forester, Blackwood, Lesmahagow.*
1882. *Fraser, Arch., Assistant Forester, Benmore Estate, Kilmun, Greenock.*
1876. FRASER, Donald, Forester, Byram, Ferry Bridge, Yorkshire.
1883. FRASER, Frank, Assistant Gardener, Balmedie, Aberdeen.
1866. FRASER, Hugh, Leith Walk Nurseries, Edinburgh.
1874. FRASER, James, Forester, Cobairdy, Huntly.
1878. *Fraser, L. A. S., Assistant Forester, Athy, Ireland.*
1857. FRASER, P. Neill, of Rockville, Murrayfield, Edinburgh.
1868. FRASER, Simon, Forester, Haddo House, Aberdeenshire.
1883. FRASER, Sweton, Assistant Forester, Eilanreoch, Glenelg, Lochalsh.

Date of Election.

1882. *French, Edward, Assistant Forester, Scone, Perth.*
1884. Frost, Francis, Forester, Kilgraston, Bridge of Earn, Perthshire.
1869. Frost, Philip, Gardener, Dropmore, Maidenhead.

1878. Galletly, James, Overseer, Bonhard, Perth.
1874. Galloway, George, Estate Offices, Woodhouses, Whitchurch, Salop.
1854. Gardiner, Robert, Agent, Birchgrove, Crosswood, Aberystwith.
1875. Gardner, George, Farmer, Carrington Barns, Gorebridge.
1870. Gilbert, James, Forester, Gallovie, Kingussie.
1880. Gilchrist, Dugald, of Ospisdale, Sutherland.
1881. Gilchrist, William, Forester, Dickson & Co.'s Nurseries, Edinburgh.
1876. Gillanders, Alexander T., Forester, Skibo Castle, Dornoch.
1876. Glassbrook, Geo., Bailiff, Remenham Farm, Henley-on-Thames, Bucks.
1880. Glen, David A., Assistant Forester, Gartshore, Kirkintilloch.
1879. Gloag, W. E., of Kincairny, Advocate, 6 Heriot Row, Edinburgh.
1869. Gordon, James, Forester, 17 Avondale Place, Edinburgh.
1884. Gordon, James W., Assistant Forester, Balmoral, Ballater.
1881. Gorrie, Thomas, Assistant Forester, Logiealmond, Perth.
1880. Gough, William C., Assistant Forester, Wykeham, York.
1869. Gow, James, Forester, Logie Cottage, Airthrey, Stirling.
1875. Gow, Peter, Overseer, Laggan, Ballantrae, Ayrshire.
1882. Gow, Robt., Assistant Forester, Raith, Kirkcaldy, Fifeshire.
1878. *Gow, Thomas, Assistant Forester, Scone, Perth.*
1884. Gow, William, Assistant Forester, Pitfour, Aberdeenshire.
1878. Grahame, James, of Auldhouse, Western Club, Glasgow.
1870. *Grandison, James, Errol Park, Errol.*
1882. Grant, Alex. M'D., Assistant Forester, Hopetoun, South Queensferry.
1873. Grant, Colonel James A., C.B., C.S.I., 19 Upper Grosvenor Street, London, W.
1867. Grant, Donald, Forester, Drumin, Ballindalloch.
1876. Grant, David, Forester, Dalvey, Forres.
1873. Grant, James, Forester, Belton House, Grantham.
1873. Grant, James, Assistant Forester, Abernethy, Strathspey.
1878. Grant, James, Assistant Forester, Drumpellier, Coatbridge.
1883. Grant, John, Assistant Forester, Balmoral, Ballater.
1875. Grant, John C., Forester, Portsoy, Banffshire.
1882. *Gray, James, Assistant Forester, Kelly, Wemyss Bay.*
1879. *Gray, Robert,* 15 *New Road, Newton-on-Ayr.*
1872. Green, Alex., Forester, Allanton House, Newmains, Lanarkshire.
1883. Green, Arthur A., 58 Broughton Street, Edinburgh.
1872. Greive, James, Messrs Dicksons & Co.'s Nurseries, Pilrig, Edinburgh.
1882. Grieve, Walter, Forester, Tyninghame, Prestonkirk.
1881. *Grigor, John, Assistant Forester, Roschaugh, Killen, Ross-shire.*

1879. Haddington, the Right Hon. the Earl of, Tyninghame, Prestonkirk.
1880. Haddon, Walter, Solicitor, Royal Bank, Hawick.
1881. Hadfield, Gordon, Forest Department, Madras.
1882. Hamilton, Donald, Assistant Forester, Dupplin Castle, Perth.

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1873. Hamilton, John B. Baillie, of Arnprior, Cambusmore, Callander.
1880. Hamilton, Robert, Trinity Lodge, Trinity, Edinburgh.
1866. Hardie, Walter, Midburn, Elstree, Herts.
1880. Harlond, Henry, 15 Boscowen Place, Morice Town, Devonport.
1873. Harrower, William, Forester, Scone, Perth.
1872. Hartland, Richard, The Lough Nurseries, Cork.
1882. Hattrick, James, Forester, Johnstone Castle, Renfrewshire.
1882. Haughs, David, Assistant Forester, Dupplin Castle, Perthshire.
1878. *Haugh, James, Assistant Forester, Colenden, Stormontfield, Perth.*
1860. Havelock, Thomas, Forester, Raby Park, Staindrop, Darlington.
1880. Havelock, W. B., Forester, Duncombe Park, Helmsley, York.
1882. Hay, Alex., 96 Constitution Street, Leith.
1869. Hayman, John, Overseer, Dumfries House, Cumnock.
1866. Henderson, Arch., Forester, Clonad Cottage, Tullamore, King's County.
1877. Henderson, George, Assistant Forester, Cavers Estate, Hawick.
1871. Henderson, John, Overseer, Vogrie, Ford, Dalkeith.
1883. Henderson, W., The Gardens, Balbirnie, Markinch.
1878. Henry, Kennedy, Assistant Forester, Hallyburton, Coupar-Angus.
1871. Hetherton, Walter, Forester, Merton, Beaford, Devon.
1873. Hilson, John, Forester, Ryther, Tadcaster, Yorks.
1882. Hodgart, James, Assistant Forester, Johnstone Castle, Renfrewshire.
1866. Hogarth, James, Forester, Culhorn, Stranraer.
1884. Hogg, Andrew, Assistant Forester, Jardine Hall, Lockerbie.
1866. Hogg, Thomas, Forester, Beau-Desert, Rugeley, Staffs.
1874. Home, Edward, Assistant Forester, Edington, Chirnside.
1872. Home, George, Assistant Forester, Bellstane, Drumlanrig, Thornhill.
1883. Homewood, Chas. E., Ufton Court, Sittingbourne, Kent.
1882. Hood, James, Assistant Forester, Freeland, Bridge of Earn, Perth.
1880. Hopetoun, The Right Hon. the Earl of, Hopetoun House, South Queensferry.
1864. Horsburgh, James, Forester, Yester, Haddington.
1882. Hoskins, Edward, Assistant Forester, Kinmel Park, Abergele, Wales.
1868. Howden & Co., The Nurseries, Inverness.
1876. Hull, Frank, Forester, Boughton Estate, Kettering, Northamptonshire.
1880. Hume, William, Iron and Wire Fence Manufacturer, 217 Buchanan Street, Glasgow.
1878. Hunter, James, Assistant Forester, Dalmeny Park, Edinburgh.
1880. Hunter, John, Forester, Dunerub Park, Dunning, Perthshire.
1884. Hunter, Wm., Forester, Drummond Castle, Muthill, Perthshire.
1873. Hussey, Samuel M., Estate Office, Tralee.
1881. Hutton, James, Forester, Glenormiston, Innerleithen, Peebles.

1880. Imrie, James, Forester and Land Steward, Rossie Castle, Montrose.
1884. Inch & Riddell, Seedsmen, Victoria Street, Edinburgh.
1882. Innes, Alex., Assistant Forester, Ruston, Brompton, York.
1884. Innes, Richard S., Upholsterer, 77 South Bridge, Edinburgh.
1870. Ireland & Thomson, Nurserymen and Seedsmen, Waterloo Place, Edinburgh.

Date of Election.

1875. Jackson, Magnus, *Photographer to the Society*, Princes Street, Perth.
1880. Jackson, Thomas, Princes Street, Perth.
1884. Jameson, Martin, Scone Estate Office, Balboughty, Perth.
1869. Jeffrey, James, Forester, Craighall, Blairgowrie.
1874. Johnston, George, The Gardens, Glamis Castle, Forfarshire.
1883. Johnston, Robert, Assistant Forester, Fryston Hall, Ferry Bridge, Yorkshire.
1870. Johnston, William, Forester, The Lee, Lanark.
1878. Johnstone, Adam, Forester, Coollattin, Shillelagh, County Wicklow, Ireland.
1882. Johnstone, Wm., Forester, Munches, Dalbeattie.
1868. Johnstone, W. W., Manager, Messrs F. & A. Dickson's Nurseries, Chester.

1867. Kay, James, Wood Manager, Bute Estate, Rothesay.
1880. Keay, Robert B., Forester, Redcastle, Inverness.
1865. Kedzie, Walter, Forester, Arundel, Sussex.
1878. *Keillor, John*, 18 *Clapperton Place, Sunnybank, Edinburgh.*
1870. Keir, David, Forester, Blair Athole, Perthshire.
1876. Kelman, John, Forester, Glenkindie, Aberdeen.
1883. Kemball, General Sir Arnold B., K.C.B., K.C.S.I., of Kembo, Uppat House, Golspie.
1882. Kennedy, John, Forester, Flakebridge, Appleby, Westmoreland.
1873. *Kennedy, John, Forester, Pitkerrald, Glen Urquhart, Drumnadrochit.*
1882. Kennedy, Walter, Forester, Skelbo, Dornoch.
1872. Kennedy, William, Overseer, Glen Carradale, Greenock.
1880. *Kerr, Wm. F., Assistant Forester, Blackwood, Lesmahagow.*
1870. Kidd, James B., Forester, The Poles, Dornoch.
1881. Kidd, William, Assistant Forester, Altyre, Forres.
1880. King, George, Forester, Kilcoy, Munlochy, Ross-shire.
1866. Kinghorn, Adam, Forester, Rochsoles, Airdrie.
1883. Kinnear, Alex., Forester, Galloway House, Garlieston.
1878. Knight, Henry, Royal Gardens, Laeken, Brussels, Belgium.
1884. Knox, Henry, Forester, Brae Lodge, Maybole, Ayrshire.
1884. Kyrke, Arthur Venables, Chard, Somersetshire.
1884. Kyrke, Richard Henry Venables, of Nantyffrith, Wrexham, North Wales.
1876. Kyrke, R. V., of Penywern, Mold.

1865. Laird, R. B., & Sons, Nurserymen and Seedsmen, 17*a* Frederick Street, Edinburgh.
1881. Laird, William, Forester, Durris, Aberdeen.
1858. Lamont, John, sen., The Glen Nurseries, Musselburgh.
1873. Lauriston, Alexander, Nurseryman, Rufford Abbey, Ollerton, Notts.
1881. Lawrie, Robert, Manager, Glencasley, Invershin, Sutherland.
1880. Lees, John, Wood Manager, Archerfield, Drem.
1878. Lees, John, Manager, Rossmore Park, Monaghan, Ireland.
1877. Lees, William, Assistant Forester, Ardgowan, Greenock.

Date of Election.

1870. Leggat, Alexander, Forester, Vale Royal, Northwich, Cheshire.
1874. Leigh, William, of Woodchester Park, Stonehouse, Gloucestershire.
1880. Leishman, John, Forester, Cavers Estate, Hawick.
1880. *Lindsay, Alexander, Manager, Eythrope, Aylesbury, Bucks.*
1879. Lindsay, Robert, Curator, Royal Botanic Garden, Edinburgh.
1884. Lindsay, Wm., Assistant Forester, Jardine Hall, Lockerbie.
1868. Little, Alexander, Forester, Relugas, Dunphail, Morayshire.
1883. Little, William, Côte, St Antoine, Montreal, Canada.
1883. Loch, Sir Henry B., K.C.B., Governor of Victoria, Australia.
1881. Low, Joseph, Forester, Rothes, Leslie House, Fife.

1881. Macaulay, James F., Forester, Castle Leod, Strathpeffer.
1876. *M'Bain, William, Forester, Clandeboye, County Down.*
1876. Macbean, John, Forester, Kinlochmoidart, Ardgour.
1872. M'Coll, James M., Factor, Craignish Castle, Lochgilphead, Argyleshire.
1882. M'Conochie, Daniel, Forester, Houston, Johnstone.
1870. M'Corquodale, D. A., Bank of Scotland, Carnoustie.
1855. M'Corquodale, Donald, Forester, Dunrobin Castle, Golspie.
1882. *M'Creath, Walter, Assistant Forester, Kelly, Wemyss Bay.*
1869. M'Cutcheon, Robert, Forester, Whittinghame, Prestonkirk.
1870. Macdonald, Alexander, Forester, Balnagowan, Parkhill, Ross-shire.
1878. Macdonald, Allan, Commissioner of Mackintosh Estates, 16 Union Street, Inverness.
1878. Macdonald, Duncan, Manager, Mulroy, Carrigart, Letterkenny, Ireland.
1877. *M'Donald, James, Assistant Forester, Lynedoch, Perth.*
1881. M'Donald, Peter, Assistant Forester, Bridgend, Islay.
1878. *M'Donald, Peter, Assistant Forester, Eylinton Castle, Irvine.*
1879. M'Dougall, Alex., Forester, Drumbuie Lodge, Dunkeld.
1882. M'Ewen, Wm. C., W.S., 9 South Charlotte Street, Edinburgh.
1880. M'Ewin, George, J.P., Glen Ewin, Houghton, South Australia.
1882. M'Farlane, John, Forester, Tarbet, Loch Lomond.
1881. M'Gilp, John, Assistant Forester, Ardgowan, Greenock.
1882. M'Gillvray, George, Assistant Forester, Altyre, Forres.
1882. M'Glashan, David, Assistant Forester, Murthly Castle, Perthshire.
1871. M'Grath, Patrick, Forester, Galtee Castle, Mitchelstown, Tipperary.
1876. *MacGregor, Alex., Forester, Lewis Castle, Stornoway.*
1881. M'Gregor, Duncan, Assistant Forester, Abernethy, Strathspey.
1878. M'Gregor, Duncan, Forester, Camperdown, Dundee.
1882. MacGregor, James G., Assistant Forester, Cally Mains, Gatehouse.
1876. M'Gregor, Robert C., Forester, Tehidy Park, Camborne, Cornwall.
1866. M'Hattie, John, Seedsman, Northgate, Chester.
1880. M'Intosh, Angus, Forester, Llanerch, Llanelly, South Wales.
1875. M'Intosh, Richard, Assistant Forester, Salton Hall, Pencaitland.
1883. M'Intyre, Alex., Assistant Forester, Craigengillan, Dalmellington, Ayrshire.
1882. M'Intyre, John, Wood Merchant, Cardross, Dumbartonshire.
1881. Mackay, George G., of Glengloy, Kingussie.
1881. Mackay, H., Timber Merchant, Shandwick, Nigg, Ross-shire.

Date of Election.

1884. M'Kay, James, Forester, Murthly Castle, Perthshire.
1875. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1882. Mackenzie, Sir Alex. Muir, Bart. of Delvine, Dunkeld.
1881. M'Kenzie, Donald, Assistant Forester, Lynedoch, Perth.
1872. M'Kenzie, Donald F., Estate Office, Morton Hall, Liberton, Edinburgh.
1880. M'Kenzie, James, Assistant Forester, Sauchie, Stirling.
1883. M'Kenzie, James, Assistant Forester, Abernethy, Strathspey.
1867. Mackenzie, John Ord, of Dolphinton, W.S., 9 Hill Street, Edinburgh —*Auditor.*
1880. Mackenzie, Major, of Findon, Mount Gerald, Dingwall.
1882. Mackie, James H. J., Land Steward, Invermay, Dunning, Perthshire.
1880. M'Killop, Alexander, Forester, Castle Menzies, Aberfeldy.
1877. M'Kinnon, Alexander, The Gardens, Scone Palace, Perth.
1883. M'Kinnon, George, The Gardens, Melville Castle, Lasswade.
1877. M'Kinnon, John, The Gardens, Kylemore Castle, County Galway.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
1870. M'Laggan, John G., Forester, The Cairnies, Glenalmond, Perthshire.
1879. M'Laren, Charles, Land Steward, Cally Lodge, Dunkeld.
1868. M'Laren, John, Ballincrieff, Drem.
1854. M'Laren, John, Forester, Hopetoun House, South Queensferry.
1879. M'Laren, John, jun., 5 St Andrew Square, Edinburgh—*Secretary* and *Treasurer.*
1878. M'Laren, John T., Overseer, Kennet, Alloa.
. M'Laren, Peter, Forester, Lilleshall, Newport, Salop.
1866. M'Laren, Peter, Forester, Altyre, Forres.
1867. M'Lean, Andrew, Forester, Rutherford, Kelso.
1876. *M'Lean, John, Forester*, 2 *Alfred Place, Canonmills.*
1872. M'Lean, Malcolm, The Gardens, Vinters Park, Maidstone, Kent.
1866. M'Lean, William, Forester, Eglinton Castle, Irvine.
1882. M'Lean, Wm., Assistant Forester, Rosehaugh, Ross-shire.
1883. Macleish, James, Hydraulic Engineer, Perth.
1865. M'Lellan, Duncan, Superintendent of Parks, 7 Kelvingrove Terrace, Glasgow.
1882. M'Lellan, Robt., 5 Dowan Vale Terrace, Partick.
1874. M'Leod, Angus A., Superintendent of City Gardens, 14 Royal Exchange, Edinburgh.
1884. MacLure, George, The Gardens, Trinity Grove, Edinburgh.
1881. Macrae, John, Forester, Higham, Bury St Edmonds.
1884. Main, Adam, Assistant Forester, Cluny Castle, Aberdeen.
1880. Marr, George, The Gardens, Hatton Castle, Turriff, Aberdeenshire.
1873. Marshall, Robert, Forester, Invercauld, Braemar, Aberdeenshire.
1871. Marshall, Robert, Bailiff, Kirklington Hall, Southwell, Notts.
1876. Martin, James, Forester, Keith Hall, Aberdeenshire.
1884. Massie, Wm. H., Knowefield Nurseries, Carlisle.
. Maxtone, Robert, Forester, Castle Strathallan, Auchterarder.
1879. Meikle, R. A., Agent for Lord Alington, Moor Crichel, Dorsetshire.
1873. Menzies, George, Agent, Trentham, Stoke-on-Trent.

Date of Election.

1880. Menzies, Wm., Forester, Dissington, Newcastle.
1854. Methven, Thomas, & Sons, Nurserymen and Seedsmen, Leith Walk Nurseries, Edinburgh.
1865. Michie, Christopher Young, Forester, Cullen House, Banffshire.
1864. Michie, James, Forester, Wemyss Castle, East Wemyss, Fife.
1871. Middlemass, Archibald, Forester, Meikleour, Perthshire.
1877. Millar, C. H., 5 Palmerston Place, Edinburgh.
1880. *Miller, James W., Manager, Skibo Castle, Dornoch.*
1883. Milroy, Alex., Forester, Glencorse, Edinburgh.
1868. Mitchell, David, 6 Comely Bank, Edinburgh.
1884. Mitchell, David, Assistant Forester, Durris, Aberdeen.
1880. Mitchell, James, Forester, Fryston Hall, Ferry Bridge, Yorkshire.
1880. Mitchell, James, Assistant Forester, Airth Castle, Larbert.
1869. Mitchell, James, Aldie Castle, Kinross.
1876. Mitchell, James, Forester, Donibristle, Aberdour, Fife.
1876. Mitchell, John, Forester, Bolton Abbey, Skipton, Yorks.
1876. More, Robert, Forester, Hafton, Kirn, Argyleshire.
1876. Morgan, George, Wood Merchant, Turret Bank, Crieff.
1875. Morgan, Hugh, Wood Merchant, Crieff.
1877. Morrison, Alexander, Nurseryman, Elgin.
1877. Morrison, James, The Gardens, Archerfield, Drem.
1862. Morrison, John, Coney Park Nursery, Stirling.
1884. Morshead, Frank Upton Anderson, Salcombe Regis, Sidmouth Devonshire.
1866. Muirhead, John, Forester, Bicton, Budleigh Salterton, Devonshire.
1876. Munro, Hugh, Forester, Holkham Hall, Norfolk.
1871. Munro, James, Assistant Forester, Darnaway Castle, Forres.
1883. Murdoch, James Barclay, Barclay, Langside, Glasgow.
1883. Murray, John, Assistant Forester, Murthly Castle, Perthshire.
1878. Murray, Robert R., Forester, Blarney Castle Estates, Cork.
1871. Myles, James, Forester, Kinnaird Castle, Brechin.

1882. Napier, Wm., Forester, Ballykelly, Londonderry.
1873. Newbigging, Alexander T., Nurseryman, Dumfries.
1879. Newton, Robert P., of Castlandhill, Polmont Bank, Polmont.
1870. Nicol, William, Forester, Cluny Castle, Aberdeen.
1869. Nicol, W. R., Forester, Loudoun Castle, Galston.

1878. Ogilvie, David, Forester, The Guynd, Arbroath.
1882. Oliver, George, Assistant Forester, Snettisham, Kings Lynn.
1868. Ormiston & Renwick, Nurserymen and Seedsmen, Melrose.

1875. Page, Andrew Duncan, Land Steward, Culzean, Maybole.
1857. Palmer & Son, John, Nurserymen, Annan.
1857. Parker, James, Forester, Belvoir Castle, Grantham.
1856. Paterson, Andrew, Agent, Paultons, Romsey, Hampshire.
1879. Paton, Hugh, Nurseryman, Kilmarnock.
1876. *Patton, Donald, 1 Livingstone Place, Edinburgh.*

Date of Election.

1870. Pearson, Joshua, Spirit Merchant, 14 Pitt Street, Glasgow.
1869. Peebles, Andrew, Estate Office, Albury, Guildford.
1873. Pender, John, M.P., 66 Old Broad Street, London, E.C.
1871. Pendreigh, John, Assistant Forester, Port Bannatyne, Rothesay.
1872. Philip, John, Wood Merchant, Bonnyrigg, Lasswade.
1882. Philip, Robt., Assistant Forester, Longleat, Horningsham, Wilts.
1878. Philips, Alexander, Land Steward, Logiealmond, Perth.
1882. Phillips, Alex., Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.
1878. Pitcaithley, Alex., Forester, Brahan Castle, Conon Bridge, Ross-shire.
1874. Platt, Major, Gorddinag, Langairfechan, near Bangor.
1877. Ponsonby, Charles John, Deputy-Conservator of Forests, Indian Forest Department, Baraitch, Oudh (12 Royal Circus, Edinburgh).
1872. Powner, George, Forester, Willey Hall, Bridgenorth, Shropshire.
1872. *Powner, Thomas, Forester, Witley Court, Stourport, Worcestershire.*
1869. Pressly, David, Glenmaroon House, Chapelizod, Dublin.
1883. Preston, Wm. M., Vaynol Park, Bangor, Wales.
1881. *Proctor, John, Assistant Forester, Kelly, Wemyss Bay.*
1879. Pryke, Walter, 1 Great Stanhope Street, Mayfair, London, W.
1878. Purdie, Robert, Forester, Castle Blaney, County Monaghan, Ireland.
1875. Purves, Alexander Paterson, W.S., 102 George Street, Edinburgh.

1876. Rae, James S., Forester, Dunipace House, Larbert.
1876. Rae, William Alexander, Durris Estate Office, Aberdeen.
1884. Rae, Wm., Forester, Kippenross, Dunblane.
1870. Rattray, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1854. Ravenscroft, Edward, 14 London Road, St John's Wood, London, N.W.
1876. *Ray, Andrew, Assistant Forester, Athronhall, Milnathort.*
1872. Reid, James S., Overseer, Kerse Estate, Falkirk.
1881. Reid, James, The Nurseries, Elgin.
1874. Renton, James, Land Agent, Cleghorn, Lanark.
1881. Riach, John, Assistant Forester, Rosehaugh, Avoch, Ross-shire.
1873. Richardson, Adam, Royal Botanic Garden, Edinburgh.
1880. *Riddall, David, Assistant Forester, Kintore.*
1877. Rider, William H., 14 Bartholomew Close, London, E.C.
1876. Ritchie, Alexander, Assistant Forester, Logiealmond, Perth.
1880. Ritchie, Wm., Assistant Forester, Lynedoch, Perth.
1882. Robertson, Alex., Assistant Forester, Eglinton Castle, Irvine.
1884. Robertson, Alex., Assistant Forester, Dupplin Castle, Perth.
1879. Robertson, Charles, Assistant Forester, Old Blair, Blair Athole.
1880. Robertson, David M., Nurseryman, Trinity, Edinburgh.
1879. Robertson, Donald, Forester, Novar, Evanton, Ross-shire.
1871. Robertson, George, Overseer, Plean, Bannockburn.
1874. Robertson, George, jun., Assistant Forester, Thirlestane Castle, Lauder.
1882. Robertson, James, Assistant Forester, Baldornoch, Blairgowrie.
1881. Robertson, John, Forester, Achnadrish, Tobermory.
1871. Robertson, John, Forester, Minto House, Hawick.
1883. Robertson, William, Assistant Forester, Murthly Castle, Perthshire.
1883. Robertson, W. H., Forester, Loughcrew, Oldcastle, Co. Meath.

Date of Election.

1883. Robertson, Wm. M., Gardener, Rossdhu, Luss, Dumbartonshire.
1869. Robertson, William W., Forester, Blinkbonny, Earlston.
1857. Robson, Alexander, Forester, Dochfour Woods, Lochend, Inverness.
1880. *Rodemer, Charles, Assistant Forester, Murthly Castle, Perthshire.*
1874. Ross, Arch., Overseer, Skipton Castle, Skipton-in-Craven, Yorkshire.
1881. Ross, John, Assistant Forester, Balnagowan Castle, Ross-shire.
1880. Ross, James, Solicitor and Factor, Inverness.
1882. *Ross, Lawson, Assistant Forester, Cavers, Hawick.*
1884. Ruddiman, Walter, Assistant Forester, Rothes Estate, Leslie, Fife.
1874. Rule, John, Forester, Monymusk, Aberdeenshire.
1867. Russell, John, Manager, Craigie House, Ayr.
1884. Russell, Thos., The Gardens, Keir House, Bridge of Allan.
1872. Rust, Joseph, The Gardens, Eridge Castle, Tunbridge Wells, Kent.
1865. Rutherford, Andrew, Agent, Lutton, Long Sutton, Lincolnshire.
1870. Rutherford, John, Forester, Linthaugh, Jedburgh.

1858. Sandbach, Henry R., Hafodunos, Abergele.
1875. Sang, Edmund, Nurseryman and Seed Merchant, Kirkcaldy.
1879. Scaling, William, Willow Nurseryman, Basford, Notts.
1871. Scarth, T. W., Land Agent, Raby Castle, Staindrop, Darlington.
1870. Scott, Adam, Forester, Southwick Park, Fareham, Hants.
1881. Scott, Andrew, Assistant Forester, Foulis-Wester, Crieff.
1883. Scott, Andrew, Schoolmaster, Forgan, Newport, Fife.
1867. Scott, Daniel, Wood Manager, Darnaway Castle, Forres.
1883. Scott, David P., 9 Renny Place, Broughty Ferry.
1881. Scott, James, Forester, Woollerton, Notts.
1879. Scott, John, Forester, Curraghmore, Portlaw, Ireland.
1880. Scott, John T., 50 Phillip Street, Chester.
1880. Scott, Walter, Overseer, Cartland, Lanark.
1867. Scott, Walter, Forester, Oxnam, Jedburgh.
1883. Scott, William, Assistant Forester, Cavers, Hawick.
1870. Shanks, John, Forester, Kildrummy Castle, Mossat, Aberdeenshire.
1881. Sherrit, James, Jun., Assistant Forester, Idvies, Forfar.
1877. Shields, Robert, Assistant Forester, Keith Hall, Aberdeenshire.
1881. *Shuan, John, Assistant Forester, Killen, Ross-shire.*
1880. Sibbald, Thomas, Assistant Forester, Cavers Estate, Hawick.
1870. Sim, William, Nurseryman, Forres.
1874. Sime, John, Timber Merchant, Rafford, Forres.
1883. Simpson, James, Dalhousie Nurseries, Broughty Ferry.
1869. *Simpson, Peter, Forester, Limefield House, West Calder.*
1882. Sinclair, Peter, Wood Merchant, Perth.
1869. Sinton, James, Forester, Stourhead Estate, Stourton, Bath.
1872. Skeldon, John, Assistant Forester, Duns Castle, Duns.
1868. Slater, Andrew, Overseer, Haystoun, Peebles.
1869. Smith, Andrew, Factor, Castlemains, Douglas, Lanarkshire.
1880. Smith, David, Forester, Woodend, Rosslyn.
1873. Smith, G. B., Wire Fence Manufacturer, 61 West Regent St., Glasgow.
1883. *Smith, Henry, Assistant Forester, Kailzie Estate, Peeblesshire.*

Date of Election.

1871. Smith, James, The Gardens, Mentmore, Leighton-Buzzard, Bucks.
1883. Smith, James, The Gardens, Moredun, Liberton, Edinburgh.
1875. *Smith, John, care of R. Smith & Co., St John's Nurseries, Worcester.*
1870. Smith, John Crombie, Forester, Portmore, Eddleston, Peebles.
1884. Smith, John Edward, Timber Buyer, 219 Rushton Road, Thornbury, near Bradford.
1870. Smith, Thomas, Nurseryman and Seedsman, Stranraer.
1869. *Smith, W. Baxter, 3 Broadlands, South Norwood, London.*
1883. Smith, William, Chemist, Stockbridge, Edinburgh.
1883. Smith, W., & Son, Patentees of the Celyddon Wire Fence, Inverness.
1878. Sothern, Peter, Forester, Broomhall, Dunfermline.
1884. Spiers, David, Overseer, Mugdrum, Newburgh, Fife.
1884. Sprot, Colonel John, of Riddell, Lilliesleaf, Roxburghshire.
1882. Stalker, Donald, Forester, Murthly Castle, Perthshire.
1864. Stapylton, Major, Myton Hall, Boroughbridge, Yorkshire.
1874. Stark, John, Forester, Springkell, Ecclefechan, Dumfries.
1873. Stephen, John, Forester, Abernethy, Strathspey.
1880. Stephens, Wm., Assistant Forester, Scone, Perth.
1868. Stewart, Alexander, Agent, Bodnaut Estate, Conway, N. Wales.
1870. Stewart, John, Forester, Castlecary, Glasgow.
1882. Stewart, John, Forester, Inveraray Castle, Argyleshire.
1875. Stewart, J. M., Cherry Tree Cottage, Nusworth, Whitefield, near Manchester.
1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1864. Stewart, William, Land Steward, Dalhousie Castle, Lasswade.
1876. Stirling, John, Forester, Cally Mains, Gatehouse of Fleet.
1876. Stuart, Charles, Forester, Glenmoriston, Inverness.
. *Stuart, John, Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.*
1878. Stuart, John, Wood Manager, Castle Grant, Grantown, Strathspey.
1868. *Stuart, Lewis A. G., Durris Estate, Aberdeenshire.*
1867. Stuart & Mein, Nurserymen, Kelso.
1876. Sturrock, David, Assistant Forester, Panmure, Carnoustie.
1878. Sturrock, William, Assistant Forester, Wemyss Castle, Dysart, Fife.
1883. Sturt, W. Neville, Union Club, London.
1883. Swan, James, Assistant Forester, Cavers, Hawick.
1872. Swan, R. G., Auctioneer, Duns.
1873. Swinton, A. Campbell, LL.D., F.R.S.E., of Kimmerghame, Duns.
1884. Syme, David, Manager, Peter Lawson & Son, Limited, Edinburgh.
1869. Symon, John, Forester, Cawdor Castle, Nairn.
1870. Symon, Peter, Town's Forester, Forres.

1869. Tait, David, Forester, Owston Park, Doncaster, Yorkshire.
1871. Taylor, David, Overseer, Barskimming, Mauchline.
1882. Taylor, William, Assistant Forester, Dupplin Castle, Perthshire.
1881. Thompson, John, Wood Merchant, Knottingley, Normanton, Yorks.
1883. Thomson, Alex., Assistant Forester, Murthly Castle, Perthshire.
1884. Thomson, B. Lumsden, 85 Gracechurch Street, London.
1884. Thomson, Charles, Assistant Forester, Jardine Hall, Lockerbie.

Date of Election.

1879. Thomson, George B., Forester, Blenheim Park, Woodstock, Oxfordshire.
1869. Thomson, Lockhart, S.S.C., 114 George Street, Edinburgh.
1871. Tomlinson, Wilson, Forester, Clumber Park, Worksop, Notts.
1883. Trotter, Lieut.-Col. H., of Morton Hall, Liberton, Edinburgh.
1881. Tulloch, Donald, Assistant Forester, Abernethy, Strathspey.
1882. Turnbull, John, Overseer, Brayton Hall, Carlisle.

1882. Ulyatt, Thomas, Assistant Forester, Rufford, Ollerton, Newark, Notts.
1883. Underwood, Henry E., Sub-Agent, Fornham, St Genevieve, Bury St Edmunds, Suffolk.

1878. Veitch, Charles, Assistant Forester, Portmore, Eddleston, Peebles.
1882. Veitch, James B., Sylhet, India.

1873. Walker, George, Forester, Balgonie, Markinch, Fife.
1879. Walker, John, Assistant Forester, Rossdhu, Luss, Dumbartonshire.
1870. Wall, G. Young, Land Agent, Grange House, Darlington.
1881. Watson, Charles, Writer, Duns.
1871. Watson, John, Gardener, Stravithie, St Andrews.
1879. Watson, John, of Earnock, Hamilton.
1872. Watt, James, of Little & Ballantyne, Nurserymen, Carlisle.
1871. Watt, William, Forester, Nisbet House, Duns.
1874. Webster, Angus D., Forester, Penrhyn Castle, Bangor, North Wales.
1884. *Webster, John, Assistant Forester, Allanton House, Newmains.*
1872. Webster, John, The Gardens, Gordon Castle, Fochabers.
1880. *Weir, George, Leith Walk Nurseries, Edinburgh.*
1866. Welsh, William M., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1882. Wemyss, Baillie, 23 Brunton Place, London Road, Edinburgh.
1882. West, J. R., Forester, Fonthill Abbey, Tisbury, Wilts.
1880. Westwood, Wm., Manager, Belladrum, Beauly.
1881. *Whan, Alexander, Assistant Forester, Cally Mains, Gatehouse of Fleet.*
1881. Whitson, A., Assistant Forester, The Nurseries, Rufford, Ollerton, Notts.
1883. Whitton, Peter, The Gardens, Methven Castle, Perth.
1884. Whitton, James, The Gardens, Coltness, Wishaw.
1884. Whyte, John, Assistant Forester, Camperdown, Dundee.
1883. Wilkie, Charles, Assistant Forester, Lennoxlove, Haddington.
1875. Wilkie, Thos., Forester, Haddington Estates, Tyninghame, Prestonkirk.
1882. Williamson, A., Wood Manager, Eridge Castle, Tunbridge Wells, Kent.
1867. Wilson, John, Forester, Doonpark, Dalbeattie.
1871. Wilson, John, Forester, Greystoke Castle, Penrith.
1872. Wilson, John, Forester, Sudbourne Hall, Wickham Market, Suffolk.
1882. Wilson, Robt., Forester, Law's Cottage, Duns.
1883. Winning, John G., Estate Office, Branxholm, Hawick.
1868. Wyllie, George, Ballogie, Aboyne, Aberdeenshire.
1884. Wyton, William, The Gardens, Heysham Hall, Lancashire.

1875. Young, William, Forester, Lennoxlove, Haddington.

3.—SUBJECTS OFFERED FOR COMPETITION DURING 1884-85.

Class I.—For Open Competition.

I. For an approved Report on the International Forestry Exhibition, Edinburgh, 1884, and the benefits to be derived therefrom. (*A Medal.*)

II. For an approved Essay on the Comparative Value of the Coniferæ, as Ornamental or Timber Trees, in Great Britain, giving the date of introduction of exotics and results obtained. (*Five Guineas* offered by Alex. Mackenzie, Esq., Superintendent, Epping Forest, Essex.)

III. For the history and details of management of the Plantations on an Estate for a period of not less than 20 years, giving the acreage, annual receipts and expenditure per acre. (*A Medal.*)

IV. For an approved Essay on economic Forestry, giving the Vernacular and Botanical names, and native countries of different trees, with the uses to which the various parts of the plant are applied. (*A Medal.*)

V. For an approved Report on the Comparative Value of the different Timber Trees grown for profit in Great Britain, and the newer Coniferæ, with rate of growth of each species in a given time. (*A Medal.*)

VI. For an approved Report on the Plantations of which the competitor is Forester or Assistant Forester. A Medal to be awarded for the best Report from England, Scotland, and Ireland, and competition to be confined to each country. Reporter to state the extent of plantations, the kinds of timber grown, soil, situation, age, management, etc. This is a standing subject. (*Three Medals, one for each Country.*)

VII. For an approved Essay on the present state and future prospects of Arboriculture in the county in which the competitor resides. This is a standing subject. (*A Medal.*)

VIII. For an approved Essay on the best system of managing Oak Plantations and Oak Coppice. Separate competition for England, Scotland, and Ireland. (*Three Medals.*)

IX. For an approved Report on Coniferæ, produced from home seed as compared with plants from foreign seed. (*A Medal.*)

X. For an approved Essay on the Natural Reproduction (by self-sowing) of Forest Trees. (*A Medal.*)

XI. For an approved Essay on the Best Method of Rearing Trees for Shelter in Deer Forests. (*A Medal.*)

XII. For an approved Report on an extensive and judiciously arranged Arboretum. (*A Medal.*)

The author to describe the conditions of soil, exposure, elevation, etc., for the respective species and varieties of trees, and the age, treatment, cost, and mode of planting adopted.

XIII. For an approved Report on the Old or Remarkable Trees on the Estate where the competitor resides, giving correct measurements of the circumference of the trunk, at 1 foot and 5 feet from the ground; the height of the bole; the total height of the tree; and its cubic contents to 8 inches in diameter. Photographs or drawings to accompany the Report. (*A Medal.*)

XIV. For an approved Report on Timber grown in Scotland and its Uses. The writer to state the principal markets for the various classes of timber, and the use to which such timber is generally put, with other details. (*A Medal.*)

XV. For an approved Essay on the Best Methods of Seasoning different Timbers. (*A Medal.*)

XVI. For an approved Essay on any Disease incidental to Forest Trees. (*A Medal.*)

XVII. For an approved Report (from personal knowledge) on the Forests of any British Colony. (*A Medal.*)

XVIII. For an approved Report (from personal knowledge) on the Forests of the United States of America. (*A Medal.*)

XIX. For an approved Report on the system of Forest Management in any Foreign country. (*A Medal.*)

Special reference to be made to appliances, modes of culture, and treatment not generally adopted in this country.

XX. For an approved Essay or Report on any other subject connected with Arboriculture. (*A Medal.*)

XXI. For any marked improvement on any of the Implements used in Forestry. (Models or implements to be accompanied by a Report.) (*A Medal.*)

XXII. To any Member of the Society who shall send to the Secretary fruits or seeds of new or rare Forest Trees fit for cultivation in this country. (*A Medal.*)

The package to be delivered free of cost to the Society, and the prize to be awarded when fifty plants of one or more kinds have been successfully raised. These plants to be the property of the Society, and balloted for amongst Members intimating their desire to have them.

Class II.—For Assistant Foresters only.

I. For an Essay on the Formation of Plantations. The writer to describe all operations necessary for laying out, planting and managing Plantations for the first twelve years. (*A Medal.*)

II. For an approved Report on the Management of a Home Nursery. (*A Medal.*)

III. For an approved Essay on the best size of Plants, and method of planting to produce the best results in different soils and situations. (*A Medal.*)

IV. For an approved Essay on the Peeling and Harvesting of different kinds of British Bark used in Tanning. (*A Medal.*)

V. For the best and approved Model in Rustic Work or in Ornamental Woodwork, of any subject designed and executed by the competitor. Model not to exceed six feet in length. (*A Medal.*)

VI. For an approved Essay or Report on any other subject connected with Arboriculture. (*A Medal.*)

The Council particularly invite the attention of young Foresters to the foregoing subjects, as they are desirous to encourage their efforts.

4.—OFFICE-BEARERS FOR 1884-85.

PRESIDENT.

Hugh Cleghorn, M.D., LL.D., F.R.S.E., of Stravithie, St Andrews.

VICE-PRESIDENTS.

The Right Hon. the Earl of Rosebery, LL.D., Dalmeny Park, Edinburgh.
Alex. Dickson, M.D., F.R.S.E., Professor of Botany in the University of Edinburgh.
Malcolm Dunn, The Palace Gardens, Dalkeith.
Robert Hutchison, F.R.S.E., of Carlowrie, Kirkliston.
John M'Gregor, Forester, Ladywell, Dunkeld.

COUNCIL.

James Robertson, Forester, Panmure, Carnoustie.
Charles S. France, Factor, Scone Palace, Perth.
James Gordon, Forester, 17 Avondale Place, Edinburgh.
John M'Laren, Forester, Hopetoun, South Queensferry.
D. F. Mackenzie, Factor, Morton Hall, Liberton, Edinburgh.
Robert Lindsay, Curator, Royal Botanic Garden, Edinburgh.
James Alexander (of Messrs Dickson & Co.), Nurseryman and Seedsman, Edinburgh.
John Methven (of Messrs Thomas Methven & Sons), Nurseryman and Seedsman, Edinburgh.
D. Scott, Forester, Darnaway Castle, Forres.
Daniel Dewar, Forester, Beaufort Castle, Beauly.
Wm. M'Corquodale, Forester and Wood Surveyor, Scone, Perth.
Robert Baxter, Forester, Dalkeith Park, Dalkeith.
John Michie, Forester, Balmoral, Ballater.
John T. M'Laren, Overseer, Kennet, Alloa.
James Kay, Forester, Bute Estate, Rothesay.

SECRETARY AND TREASURER.

John M'Laren, Jun., 5 St Andrew Square, Edinburgh.

AUDITOR.

John Ord Mackenzie, of Dolphinton, W.S., 9 Hill Street, Edinburgh.

JUDGES.

Dr Cleghorn (*Convener*) of Stravithie, St Andrews.
Charles S. France, Factor, Scone Estate, Perth.
D. F. Mackenzie, Factor, Morton Hall, Liberton, Edinburgh.

COMMITTEE ON TRANSACTIONS.

Dr Cleghorn (*Convener*) of Stravithie, St Andrews.
Robert Hutchison of Carlowrie, 29 Chester Street, Edinburgh.

CHARLES S. FRANCE, Factor, Scone Estate, Perth.
Professor I. BAYLEY BALFOUR, Oxford University.
Professor ALEX. DICKSON, 11 Royal Circus, Edinburgh.

PHOTOGRAPHIC ARTIST.

MAGNUS JACKSON, 62 Princes Street, Perth.

LOCAL SECRETARIES.

Scotland.

DANIEL DEWAR, Forester, Beaufort Castle, Beauly.
JOHN FINGLAND, Forester, Drumlanrig, Thornhill, Dumfriesshire.
JAMES KAY, Forester, Bute Estate, Rothesay.
DONALD M'CORQUODALE, Forester, Dunrobin Castle, Golspie.
WILLIAM M'LEAN, Forester, Eglinton Castle, Irvine.
C. Y. MICHIE, Forester, Cullen House, Banffshire.
JAMES ROBERTSON, Forester, Panmure House, Carnoustie.
WILLIAM W. ROBERTSON, Forester, Blinkbonny, Earlston.

England.

JAMES BARRIE, Forester, Stevenstone Estate, Torrington, Devon.
JAMES BELL, The Gardens, Stratfieldsaye, Winchfield, Hants.
JAMES DUFF, Forester, Bayham Abbey, Tunbridge Wells, Kent.
THOMAS HOGG, Forester, Beau Desert, Rugeley, Staffordshire.
ANDREW PATERSON, Agent, Paultons, Romsey, Hants.
JAMES RUTHERFORD, Agent, Kirkleatham, Redcar, Yorkshire.
GEORGE DODDS, Overseer, Wyreside Cottage, Lancaster.
JOHN WILSON, Forester, Sudbourne Hall, Wickham Market, Suffolk.

Ireland.

JAMES ARCHER, Forester, Woodstock, Inistiogue, County Kilkenny.
ROBERT COUPAR, Forester, Ashford, Cong, County Galway.
DUNCAN MACDONALD, Manager, Mulroy, Carrigart, Letterkenny.

The Council have resolved to open a Fund to defray the expenses incurred in illustrating the Society's *Transactions*, and solicit contributions thereto.

The following donations have been received:

Professor Dickson, ...	£1
Dr Cleghorn, ...	1
D. F. Mackenzie, Factor, Morton Hall, .	2

The Council wish it to be known that the Society has an Album for the Photographs of Members, and the Secretary will be glad to receive contributions.

ABSTRACT of the ACCOUNTS of the SCOTTISH ARBORICULTURAL SOCIETY for YEAR 1883-84.

Branch	CHARGE.			
I.	Balance brought forward from last Account,			£0 16 6
II.	Arrears of Subscriptions received,			11 18 6
III.	Amount of Subscriptions received,			74 12 0
IV.	Sums received for Life Membership,			69 6 0
V.	Sums received for Advertisements in the Society's Publications,			9 6 6
VI.	Dividend on Bank of Scotland Stock, October 1883 and April 1884,			14 0 0
VII.	Sums received from Members attending Excursion to Selkirk in October 1883 towards expenses of same,			6 19 0
VIII.	Contributions to Illustration Fund,			4 0 0
IX.	Donations,			5 5 0
X.	Balance of Operations on Bank Current Account,			4 1 3
XI.	Miscellaneous Receipts,			4 15 0
XII.	Interest on Current Account with National Bank,	£0 4 8		
	Do. on Capital do. do.,	0 11 1		
			0 15 9	
	Amount of Charge,			£205 15 6

Branch	DISCHARGE.			
I.	Prizes paid in money,			£9 16 0
II.	Salary to Secretary and Treasurer,			40 0 0
III.	Accounts paid,			98 14 7
IV.	Incidental Expenses,			11 0 6
V.	Amount of Life Subscriptions paid into Capital Account with National Bank, with interest,			46 4 5
	Amount of Discharge equalling Charge,			£205 15 6

STATE of the FUNDS as at 2d AUGUST 1884.

Sinking Fund, being price paid for One Share Bank of Scotland Stock, and expenses of Transfer,	£327 5 0	
Amount of Capital Account with National Bank, including interest to 2d August 1884,	80 14 8	
	£407 19 8	
Less overdrawn from National Bank,	2 16 10	
Nett Funds of the Society,		£405 2 10

APPENDIX (B.)

Scottish Arboricultural Society.

PATRON—HER MOST GRACIOUS MAJESTY THE QUEEN.

1.—FORMER PRESIDENTS.

YEAR.		MEMBERS.
1854-55.	JAMES BROWN, Deputy-Surveyor of the Royal Forest of Dean,	35
1855-56.	Ditto, Wood Commissioner to the Earl of Seafield,	59
1856-57.	Ditto, ditto,	92
1857-58.	The Right Hon. THE EARL OF DUCIE,	142
1858-59.	The Right Hon. THE EARL OF STAIR,	167
1859-60.	Sir JOHN HALL, Bart., of Dunglass,	170
1860-61.	His Grace THE DUKE OF ATHOLE,	182
1861-62.	JOHN J. CHALMERS of Aldbar,	159
1862-63.	The Right Hon. THE EARL OF AIRLIE,	163
1863-64.	The Right Hon. T. F. KENNEDY,	151
1864-65.	ROBERT HUTCHISON of Carlowrie, F.R.S.E.,	162
1865-66.	Ditto, ditto,	168
1866-67.	Ditto, ditto,	220
1867-68.	Ditto, ditto,	284
1868-69.	Ditto, ditto,	367
1869-70.	Ditto, ditto,	464
1870-71.	Ditto, ditto,	549
1871-72.	Ditto, ditto,	612
1872-73.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie,	658
1873-74.	Ditto, ditto,	665
1874-75.	JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS.L. & E., Professor of Botany in the University of Edinburgh,	681
1875-76.	Ditto, ditto,	698
1876-77.	The Right Hon. W. P. ADAM of Blairadam, M.P.,	731
1877-78.	Ditto, ditto,	750
1878-79.	Ditto, ditto,	730
1879-80.	The Most Hon. THE MARQUIS OF LOTHIAN, K.T.,	732
1880-81.	Ditto, ditto,	740
1881-82.	Ditto, ditto,	745
1882-83.	ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh,	693
1883-84.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie,	756
1884-85.	Ditto, ditto,	772

2.—LIST OF MEMBERS.

Corrected to July 1886.

The Names of Members whose present Address is not known to the Secretary are printed in italics.

Law V. Members in arrear shall not receive the *Transactions* while their Subscriptions remain unpaid. Any Member whose Annual Subscription to the Society remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till he shall have paid up his arrears.

Date of Election.

HONORARY MEMBERS.

1873. Brandis, Dietrich, Ph.D., *Ex*-Inspector-General of Forests in India, Bonn, Germany.
1868. Bullen, Robert, Curator of the Botanic Garden, Glasgow.
1864. Hutchison, Robert, F.R.S.E., of Carlowrie, 29 Chester St., Edinburgh.
1856. Lawson, George, LL.D., Ph.D., Professor of Natural History and Chemistry, Dalhousie College, Halifax, Nova Scotia.
1854. M'Corquodale, William, Forester and Wood Surveyor, Jeanie Bank, Perth (also a *Life* Member by composition).
1881. Temple, Sir Richard, Bart., G.C.S.I., The Nash, Worcestershire.

LIFE MEMBERS.

1875. Acland, Sir Thomas Dyke, Bart., M.P., of Killerton, Exeter.
1883. Adam, Sir Charles Elphinstone, Bart. of Blair Adam, Kinross-shire.
1883. Alexander, John, Kirklees, Uda Pusalawa, Ceylon.
1883. Athole, His Grace the Duke of, K.T., Blair Castle, Blair Athole.
1884. Balfour of Burleigh, The Right Hon. Lord, Kennet House, Alloa.
1870. Barbour, George F., of Bonskeid, Pitlochrie, Perthshire.
1866. Barrie, James, Forester, Stevenstone, Torrington, North Devon.
1884. Bates, Cadwallader John, of Heddon and Langley Castle, Northumberland.
1871. Bell, William, of Gribdae, Kirkcudbright.
1875. Bertram, William, Ellengowan Villa, Newington, Edinburgh.
1877. Bolckow, C. F. H., of Brackenhoe, Middlesboro'-on-Tees.
1881. Brodie of Brodie, Brodie Castle, Forres.
1882. Bruce, Hon. Robert Preston, M.P., Broomhall, Dunfermline.
1871. Bruce, Hon. T. C., 24 Hill Street, Berkeley Square, London, W.
1867. Bruce, Thomas Rae, of Slogarie, New Galloway Station.
1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Park, Dalkeith.
1877. Clay, J. Spender, Ford Manor, Lingfield, Surrey.

Date of Election.

1865. Cleghorn, Hugh, M.D., F.R.S.E., of Stravithie, St Andrews, Fife.
1872. Clerk, Sir George D., Bart., Penicuik House, Penicuik.
1879. Colquhoun, Andrew, Forester, Rossdhu, Luss, Dumbartonshire.
1876. Cowan, Charles W., younger of Logan House, Valleyfield, Penicuik.
1875. Craig, William, M.D., C.M., F.R.S.E., 7 Lothian Road, Edinburgh.
1865. Crawford, William Stirling, of Milton, Glasgow.
1865. Cross, David G., Forester, Kylisk, Nenagh, Ireland.
1880. Cumberbatch, L. H., Holt Cottage, Brockenhurst, Hants.
1880. Curr, Henry, Factor, Pitkellony House, Muthill, Perthshire.
1884. Currie, Sir Donald, K.C.M.G., M.P., of Garth Castle, 13 Hyde Park Place, London, W.
1867. Dalgleish, John J., of Ardnamurchan, 8 Athole Crescent, Edinburgh.
1876. Dalgleish, Laurence, of Dalbeath, 8 Athole Crescent, Edinburgh.
1882. Dalhousie, The Right Hon. The Earl of, K.T., Brechin Castle, Brechin.
1877. Dewar, Daniel, Forester, Beaufort Castle, Beauly.
1871. Duncan, Alexander, of Knossington Grange, Oakham, Leicestershire.
1875. Duncan, James, of Benmore, Kilmun, Greenock.
1883. Dundas, Charles H., of Dunira, Dalhonzie, Crieff.
1872. Dundas, Robert, of Arniston, Gorebridge.
1875. Eastwood, James, The Gardens, Bryn-y-Newadd, Bangor, North Wales.
1876. Edwards, William Peacock, S.S.C., 21 Hill Street, Edinburgh.
1881. Elliot, Walter, Manager, Ardtornish, Morven, Oban.
1869. Fish, D. T., Hardwick House, Bury St Edmunds.
1874. Fitzwilliam, The Right Hon. the Earl, K.G., Wentworth, Rotherham, Yorkshire.
1881. Forbes, Arthur Drummond, Millearne, Auchterarder, Perthshire.
1866. France, Charles S., Factor to the Earl of Mansfield, Scone, Perth.
1856. Gough, William, Wood Manager, Wykeham, York.
1884. Graham, Wm., of Erins, Tarbert, Lochfyne.
1880. Grant, Sir George Macpherson, Bart., M.P., Ballindalloch Castle, Banffshire.
1874. Grant, John, Overseer, Daldowie, Tollcross.
1867. Grimond, Alexander D., of Glenericht, Blairgowrie.
1880. Hare, Colonel, Philpstoun House, Winchburgh.
1874. Herbert, H. A., of Muckross, Killarney.
1884. Heywood, Arthur, Sudbourne Hall, Wickham Market, Suffolk.
1871. Hope, H. W., of Luffness, Drem.
. Horne, John, Director, Forests and Gardens, Mauritius, per Messrs Richardson & Co., 13 Pall Mall, London, W.C.
1876. Horsburgh, John, Photographist and Portrait Painter, 131 Princes Street, Edinburgh.
1874. Hubbard, Egerton, M.P., of Addington Manor, Winslow, Bucks.
1869. Huth, Louis, of Possingworth, Hawkhurst, Sussex.
Hutton, James, Bankfoot, Perth.
1884. Inglis, Alex., Breadalbane Estate Office, Aberfeldy.
1866. Jeffrey, John, of Balsusney, Kirkcaldy, Fife.
1880. Jenner, Charles, Easter Duddingston Lodge, Edinburgh.
1882. Jonas, Henry, Land Agent and Surveyor, 4 Whitehall, London, S.W.

Date of Election.

1876. Leicester, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.
1868. Leslie, Charles P., of Castle-Leslie, Glasslough, Ireland.
1874. Leslie, The Hon. George Waldegrave, Leslie House, Leslie, Fife.
1883. Loney, Peter, Estate Agent, Marchmont, Duns.
1881. Lonsdale, Claud, Rose Hill, Carlisle.
1869. Lothian, The Most Hon. the Marquis of, K.T., Newbattle Abbey, Dalkeith.
1880. Lovat, The Right Hon. Lord, Beaufort Castle, Beauly.
1880. Love, J. W., care of Mrs J. Boyce, Semaphore, Lefevre's Peninsula, South Australia.
1875. Lovelace, The Right Hon. the Earl of, East Horsley Towers, Woking Station, Surrey.
1881. Lumsden, David, of Pitcairnfield, Perth.
1875. Luttrell, George F., of Dunster Castle, Taunton, Somersetshire.
1874. Macdonald, Ranald, Factor, Cluny Castle, Aberdeenshire.
1876. M'Dougall, Captain J. W., jun., of Orchill, Braco, Perthshire.
1884. Macduff, Alex., of Bonhard, Perth.
1868. M'Gregor, John, Forester, Ladywell, Dunkeld, Perthshire.
1879. M'Intosh, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1882. M'Kenzie, Alex., Superintendent of Epping Forest, The Warren, Loughton, Essex.
1869. Mackenzie, Colin, J., of Portmore, Eddleston, Peebles.
1872. M'Kenzie, Donald F., Estate Office, Morton Hall, Edinburgh.
1880. Mackenzie, Sir Kenneth, Bart., Conon House, Dingwall.
1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
1857. MacTier, A. W., "Rothesay," Bournemouth, Hants.
1880. Malcolm, Lieut.-Col. E. D., R.E., 18 Queen's Gate Place, London, S.W.
1871. Maxwell, Wellwood H., of Munches, Dalbeattie.
1880. Mesham, Captain, Pontryffydd, Bodvari, Rhyl.
1881. Michie, John, Forester, Balmoral, Ballater.
1858. Minto, The Right Hon. the Earl of, Minto House, Hawick.
1882. Mitchell, Francis, Forester, Warwick Castle, Warwick.
1871. Moore, Thomas, F.L.S., Curator, Botanic Garden, Chelsea.
1881. Naylor, Christopher John, Brynellywarch, Kerry, Montgomeryshire.
1883. Paton, Chalmers Izett, of Belstane, Kirknewton.
1856. Portsmouth, The Right Hon. the Earl of, Eggesford, North Devon.
1878. Punchard, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.
1855. Ramsden, Sir John, Bart., 6 Upper Brook Street, London, W.
1874. Ridley, G., 2 Charles Street, Berkeley Square, London, W.
1876. Ritchie, William, of Middleton, Gorebridge, Edinburgh.
1866. Robertson, James, Wood Manager, Panmure, Carnoustie.
1883. Rollo, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
1872. Rosebery, The Right Hon. the Earl of, Dalmeny Park, Edinburgh.
1871. Rosslyn, The Right Hon. the Earl of, Dysart House, Fife.
1854. Rutherford, James, Agent, Kirkleatham, Redcar, Yorkshire.

Date of Election.

1877. Smith, Thomas Valentine, of Ardtornish, Morvern, Argyleshire (111 Grosvenor Road, London. S.W.).
1882. Smythe, David M., yr. of Methven Castle, Perth.
1883. Sprot, Captain Alexander, of Garnkirk.
1883. Stafford, The Most Hon. the Marquis of, M.P., Dunrobin Castle, Golspie.
1873. Stair, The Right Hon. the Earl of, Lochinch, Castle Kennedy, Wigtownshire.
1883. Stormont, The Right Hon. Viscount, Scone Palace, Perth.
1880. Sutherland, Evan C., of Skibo Castle, Dornoch.
1865. Talbert, Peter, Forester, Glenericht, Blairgowrie.
1877. Terris, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1880. Thomson, Alexander, 35 Chester Street, Edinburgh.
1855. Thomson, John Grant, Wood Manager, Grantown, Strathspey.
1883. Trotter, Colonel H., of Morton Hall, Edinburgh.
1872. Trotter, Colonel, R.A., The Bush, Edinburgh.
1878. Turnbull, John, of Abbey St Bathans, 49 George Square, Edinburgh.
1872. Urquhart, B. C., of Meldrum, Aberdeenshire.
1878. Walker, Major I. Campbell, Conservator of Forests, Forest Office, Madras.
1872. Waveney, Lord, Flixton Hall, Bungay, Suffolk.
1872. Wemyss, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
1869. Wild, Albert Edward, Conservator of Forests, Punjab, India (care of W. Wild, Wath-upon-Dearne, Rotherham, Yorkshire).
1861. Wilson, John, F.R.S.E., Professor of Agriculture, University, Edinburgh.

ORDINARY MEMBERS.

1882. Ahlbottn, Nathaniel, Tree Protective Composition Manufacturer, 50 Shore, Leith.
1856. Airlie, The Right Hon. the Earl of, Cortachy Castle, Forfarshire.
1878. Aitken, Andrew Peebles, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.
1872. Alexander, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1883. Allan, Alex., Forester, Mitchelstown Castle, County Cork.
1865. Allan, John, Forester, Dalmeny Park, Edinburgh.
1882. Allan, Thomas G., Ironmonger, Helensburgh.
1869. Anderson, Alexander, Forester, St Fort, Newport, Dundee.
1869. Anderson, Alexander, Gardener, Musselburgh.
1883. Anderson, David, Assistant Forester, Inver, Dunkeld.
1880. Anderson, George, Timber Merchant, Bonar Bridge.
1883. Anderson, Hector, Assistant Forester, Ardross, Alness, Ross-shire.
1883. Anderson, James, Forester, Early Wood, Bagshot, Surrey.
1881. Anderson, Peter, Forester, Dupplin Castle, Perth.
1881. Anderson, Thomas R., Assistant Forester, Idvies, Forfar.
1872. Annandale, Robert B., Adderley Lodge, Market Drayton, Shropshire.
1871. Archer, James, Forester, Woodstock, Inistiogue, County Kilkenny.
1867. *Archibald, Thomas, Forester, Monkwray, Whitehaven, Cumberland.*

Date of Election.

1883. Argyll, His Grace the Duke of, K.T., LL.D., D.C.L., F.R.S., F.G.S., Inverary Castle, Argyleshire.

1860. Austin & M'Aslan, Nurserymen and Seedsmen, Buchanan St., Glasgow.

1877. Bain, W. P. C., Lochrin Ironworks, Lower Gilmore Place, Edinburgh.

1880. Baines, W. M., of Bell Hall, York.

1880. Balden, John, Dilston, Corbridge-on-Tyne, Northumberland.

1880. Balden, Robert S., Wood Manager, Castle Howard, York.

1877. Balfour, Isaac Bayley, Sc.D., M.D., F.L.S., Professor of Botany, Oxford.

1877. Barclay, David, Forester, Routenburn, Largs, Ayrshire.

1884. Barrett, Robert Bell, Estate Agent, Skipton Castle, Skipton, Yorkshire.

1867. Barrie, David, Forester, Comlongan Castle, Annan.

1882. Barrie, John, Land Steward, Gateforth Hall, Selby, Yorkshire.

1877. Barry, John W., of Fylingdales, Whitby.

1874. Barton, James, Forester, Hatfield House, Herts.

1871. Baxter, Robert, Forester, Dalkeith Park, Dalkeith.

1858. Baxter, William, Forester, Dunrobin, Golspie.

1870. Bayne, Lewis, Forester, Kinmel Park, Abergele, North Wales.

1878. Bell, Andrew, Assistant Forester, Yester, Haddington.

1883. Bell, Andrew, Forester, Broomhall, Charlestown, Fife.

1866. Bell, James, The Gardens, Stratfieldsaye, Winchfield, Hants.

1884. Bell, Robert, The Gardens, Morton Hall, Liberton, Edinburgh.

1884. Bett, Thomas, Factor, Portbane, Kenmore, Aberfeldy.

1869. Birch, John, The Gardens, Windlestone Hall, Ferry Hill, Durham.

1876. Bisset, Alexander, Manager, Balfarg, Markinch, Fife.

1869. Bissett, William S., Overseer, Moncrieffe House, Perth.

1883. Blake, Jas., Forester, Morton Hall, Edinburgh.

1869. Boa, Andrew, Land Steward, Dalton House, Newcastle-on-Tyne.

1872. Boa, Andrew, jun., Sub-Agent, Great Thurlow, Newmarket, Suffolk.

1876. Booth, John, of Flottbeck Nurseries, Hamburg.

1857. Borthwick, William, Forester, Dunnichen, Forfar.

1882. Boss, John, Jun., Assistant Forester, Hopetoun, South Queensferry.

1883. Boyd, John, Assistant Forester, Kilmahew, Cardross.

1860. Brodie, James, Land Steward, Glasslough, Armagh, Ireland.

1880. Brodie, Thomas D., W.S., 5 Thistle Street, Edinburgh.

1881. Brodie, Vernon Alex., Civil Service, Madras.

1880. Brotherston, R. P., The Gardens, Tyninghame, Prestonkirk.

1874. *Brown, Andrew, Assistant Forester, Portmore, Eddlestone.*

1879. *Brown, George E., Forester, Cumloden, Newton-Stewart.*

1878. Brown, J. A. Harvie, of Quarter, Dunipace House, Larbert.

1868. Brown, John E., F.L.S., Conservator of Forests, Forest Board Office, Adelaide, S.W.

1878. Brown, Robert, Forester, Blackwood, Lesmahagow.

1884. Brown, Thomas, Forester, Craigingillan, Dalmellington.

1883. Browning, John, The Gardens, Dupplin Castle, Perth.

1885. Bruce, Thomas, Assistant Forester, Kinnaird Castle, Brechin.

Date of Election.

1870. Bryan, F. G. D., Factor, Drumpellier, Coatbridge.
1873. Brydon, John, Forester, Rothes, Elgin.
1873. Buchan, Alexander, A.M., F.R.S.E., Secretary of the Scottish Meteorological Society, 72 Northumberland Street, Edinburgh.
1877. Buchan, William, Forester, Grangemuir, Pittenweem, Fife.
1879. Buchanan, Charles, Overseer, Penicuik House, Penicuik.
1865. Buchanan, Robert R., Forester, Duns Castle, Duns.
1880. Buddicom, W. B., Penbedw, Mold, Flintshire.
1875. Burgess, William, Forester, Drumpellier, Coatbridge.
1884. Burrows, Alfred J., F.S.I., F.L.S., Land Steward, Pluckley, Kent.

1870. Cameron, Alexander, Forester, Countlich Lodge, Ballinluig, Perthshire.
1881. *Cameron, Alex., Assistant Forester, Gask, Perth.*
1876. *Cameron, Donald, 9 Canon Street, Canonmills, Edinburgh.*
1879. *Cameron, H. W., Forester, Rosehaugh, Killen, Ross-shire.*
1881. *Cameron, Joseph, Assistant Forester, Rosehaugh, Killen, Ross-shire.*
1866. Cameron, Robert, Forester, Pale, Corwen, North Wales.
1867. Campbell, Alexander, Forester, Old Manse, Liff, Dundee.
1882. Campbell, Alex., Assistant Forester, Murthly, Perthshire.
1865. Campbell, James, of Tillichewan Castle, Dumbartonshire.
1883. Campbell, John M., Assistant Curator, City Museum, Kelvingrove Park, Glasgow.
1878. Cantley, N., Superintendent, Botanical Gardens, Straits Settlements.
1870. Chaplain, George, Assistant Forester, Glamis Castle, Forfarshire.
1867. Chirnside, Francis, Forester, Ladykirk, Berwickshire.
1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1884. Christie, Alex. D., The Gardens, Warwick Castle, Warwickshire.
1883. Christie, William, Nurseryman, Fochabers.
1871. Churnside, Robert, Forester, Edlingham, Alnwick.
1872. Clark, David, Forester, Elie House, Elie, Fife.
1866. Clark, James, Forester, Balvaird Cottage, Strathmiglo, Fife.
1867. Clark, John, Ground Officer, Keith Hall, Aberdeenshire.
1867. Clark, John, Forester, Kelly, Wemyss Bay.
1882. *Clark, Wm., Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.*
1870. Cobban, John, Wood Agent, Wentworth Woods, Rotherham, Yorks.
1869. Cockburn, William, Forester, Willowbank, Penicuik.
1867. Cocker, James, The Nurseries, Sunnypark, Aberdeen.
1882. Collins, Robt. T., Forester, Trentham, Stoke-on-Trent, Staffordshire.
1869. Corbett, James, Forester, Underley Hall, Kirkby Lonsdale, Westmoreland.
1877. Corbett, John, Forester, Dallam Tower, Milnthorpe, Westmoreland.
1876. Coupar, George, 24 St Andrew Square, Edinburgh.
1879. Coupar, Robert, Forester, Ashford, Cong, County Galway.
1858. Cowan, James, Forester, Bridgend, Islay.
1872. Cowie, John, Assistant Forester, Mountstuart, Rothesay.
1874. Cowper, R. W., Assistant Agent, 81 High Street, Sittingbourne.
1875. Crabbe, David, Forester, Cortachy Castle, Kirriemuir.
1867. Crabbe, James, Forester, Glamis Castle, Forfarshire.

Date of Election.

1880. Crawhall, George, Burton Croft, York.
1882. Crearer, John, Assistant Forester, Scone, Perth.
1876. Cromb, James, Assistant Forester, Kelly Castle, Arbirlot, Arbroath.
1873. Crosbie, John, Forester, Ballindalloch Castle, Banffshire.
1873. Cumming, Donald, Lynwilg Hotel, Aviemore, Inverness-shire.
1884. Cumming, John, Assistant Forester, Keith Hall, Aberdeenshire.
1883. Cunningham, Alex., Assistant Forester, Ardross, Alness, Ross-shire.
1881. Cunninghame, J. C., of Craigends, Johnstone, Renfrewshire.
1868. Cunningham, John, Forester, Ardross, Alness, Ross-shire.
1880. Curr, James, Kindar Lodge, Dumfries.
1885. Curtis, Charles, Assistant Superintendent of Forests, Penang.

1884. Dalziel, James, Forester, Culzean Castle, Maybole, Ayrshire.
1869. Daniels, Peter, Forester, Slindon Hall, Arundel, Sussex.
1884. Davidson, Alex., Assistant Forester, Durris, Aberdeen.
1874. Davidson, George, Land Steward, Carriden, Linlithgow.
1883. Davidson, James, Assistant Forester, Cavers, Hawick.
1865. Davidson, John, Land Agent, Greenwich Hospital Estates, Haydon Bridge, Northumberland.
1857. Davidson, John, Forester, Aldbar, Brechin.
1884. Deane-Drake, Joseph Edward, Stokestown House, New Ross, Ireland.
1883. Denne, John, Jun., Greenstreet, Sittingbourne, Kent.
1877. Dewar, John, Assistant Forester, Altyre, Forres.
1882. Dick, Archd., Assistant Forester, Hopetoun, South Queensferry.
1883. Dickie, James, Gardener, Curraghmore, Portlaw, Waterford.
1879. Dickson, Alex., M.D., F.R.S.E., of Hartree, Professor of Botany in University of Edinburgh (11 Royal Circus).
1884. Dickson, A., Steward, Baron's Court, Tyrone, Ireland.
1870. Dickson & Sons, James, Newton Nurseries, Chester.
1858. Dickson & Sons, James, Nurserymen and Seedsmen, 32 Hanover Street, Edinburgh.
1854. Dickson & Turnbull, Nurserymen and Seedsmen, Perth.
1868. Dodds, George, Overseer, Wyreside Cottage, Lancaster.
1877. Doig, Charles, Overseer, Glen Tulchan, Methven, Perth.
1880. *Doragh, Andrew, Foreman, The Gardens, Knockmaroon Lodge, Chapelizod, Dublin.*
1882. Douglas, Captain Palmer, of Cavers, Hawick.
1884. Doughty, Wm., Forester, Langholm Estate, Canonbie, Dumfriesshire.
1867. Dow, Thomas, Overseer, Idvies, Forfar.
1862. Drummond & Sons, William, Nurserymen, Stirling.
1866. Duff, James, Factor, Blackwood, Lesmahagow.
1868. Duff, James, Freeland, Forgandenny, Perthshire.
1868. Duff, James, Wood Manager, Bells Yew Green, Tunbridge Wells, Kent.
1884. Dunphy, Edward, Timber Merchant, Inistiogue, Kilkenny.
1875. Duncan, James, Land Steward, Glack, Old Meldrum.
1862. Duncan, William, Forester, Ardgowan, Greenock.
1885. Dunn, David, Superintendent, Queen's Park, Heywood, Manchester.
1867. Dunn, Malcolm, The Palace Gardens, Dalkeith.

Date of Election.

1873. DURWARD, Robert, Manager, Blelack, Dinnet, Aberdeenshire.

1885. EDDINGTON, Francis, Assistant Forester, Yester, Gifford.
1873. EDEN, The Hon. R. Henley, Minety House, Malmesbury, Wilts.
1884. EDEN, Henley, Agent to His Grace the Duke of Somerset, Bradley Estate Office, Maiden Bradley, Bath.
1882. ELDER, Wm., Forester, 40 Susannah Street, Alexandria, Dumbartonshire.
1878. ELLIOT, Sir Walter, K.C.S.I., F.R.S., Wolfelee, Hawick.
1877. ERSKINE, William, of Oaklands, Trinity.
1881. EWART, Andrew, Gardener, Moniack, Beauly.
1873. EWING, David, Forester, Strichen House, Aberdeen.

1879. FALCONER, Dr John, St Anns, Lasswade.
1884. FARQUHARSON, George, Assistant Forester, Durris, Aberdeen.
1869. FERGUSON, Alex., 21 Duddingston Park, Portobello.
1880. FERGUSSON, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1884. FERGUSON, Wm. Hooker, Knowefield Nurseries, Carlisle.
1872. FINGLAND, John, Forester, Drumlanrig, Thornhill, Dumfriesshire.
1879. FINLAY, Thos., Assistant Forester, Hopetoun House, South Queensferry.
1883. FINLAYSON, Robert, Assistant Forester, Hopetoun, South Queensferry.
1869. FISHER, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1876. FISKIN, Alexander, Assistant Forester, Rossdhu, Dumbartonshire.
1884. FLEMING, John, Camperdown Saw-Mills, Dundee.
1885. FLEMING, J. B., "Beaconsfield," Kelvinside, Glasgow.
1864. FORBES, Andrew, Forester, Stracathro, Brechin.
1884. FORBES, Alex. J., Marybank School, Muir of Ord.
1882. FORBES, David, Assistant Forester, Salton Hall, Pencaitland.
1884. FORBES, John, Buccleuch Nurseries, Hawick.
1878. FORBES, Robert, Forester, Jardine Hall, Lockerbie.
1873. FORBES, William, Stoneleigh Estate Office, Kenilworth, Warwickshire.
1869. FORGAN, James, Gardener and Overseer, Bonskeid, Pitlochrie.
1884. FORREST, Thomas, Assistant Forester, Allanton House, Newmains.
1883. FORREST, Sir William J., Bart. of Comiston, Edinburgh.
1883. FORRESTER, John, Architect, 37 Broughton Place, Edinburgh.
1878. FORSYTHE, John M., Wood Manager, Park Farm Office, Woburn, Bedfordshire.
1880. FOTHERINGHAM, Alex., Manager, Newholme, Dolphinton.
1884. FOULIS, Thomas, Publisher, 9 South Castle Street, Edinburgh.
1882. *Fowler, Alex., Assistant Forester, Blackwood, Lesmahagow.*
1882. *Fraser, Arch., Assistant Forester, Benmore Estate, Kilmun, Greenock.*
1876. FRASER, Donald, Forester, Poole, South Milford, Yorkshire.
1883. FRASER, Frank, Assistant Gardener, Balmedie, Aberdeen.
1866. FRASER, Hugh, Leith Walk Nurseries, Edinburgh.
1874. FRASER, James, Forester, Cobairdy, Huntly.
1878. *Fraser, L. A. S., Assistant Forester, Athy, Ireland.*
1857. FRASER, P. Neill, of Rockville, Murrayfield, Edinburgh.
1868. FRASER, Simon, Forester, Haddo House, Aberdeenshire.
1883. FRASER, Sweton, Assistant Forester, Eilanreoch, Glenelg, Lochalsh.
1882. *French, Edward, Assistant Forester, Scone, Perth.*

Date of Election.

1884. Frost, Francis, Forester, Kilgraston, Bridge of Earn, Perthshire.
1869. Frost, Philip, Gardener, Dropmore, Maidenhead.

1878. Galletly, James, Overseer, Bonhard, Perth.
1874. Galloway, George, Estate Offices, Woodhouses, Whitchurch, Salop.
1854. Gardiner, Robert, Agent, Birchgrove, Crosswood, Aberystwith.
1875. Gardner, George, Farmer, Carrington Barns, Gorebridge.
1885. Gibb, James, Assistant Forester, Kinnaird Castle, Brechin.
1870. Gilbert, James, Forester, Gallovie, Kingussie.
1880. Gilchrist, Dugald, of Ospisdale, Sutherland.
1881. Gilchrist, William, Forester, 35 Moray Street, Elgin.
1876. Gillanders, Alex. T., Forester, High Legh Hall, Knutsford, Cheshire.
1876. Glassbrook, Geo., Bailiff, Remenham Farm, Henley-on-Thames, Bucks.
1880. Glen, David A., Assistant Forester, Gartshore, Kirkintilloch.
1879. Gloag, W. E., of Kincairny, Advocate, 6 Heriot Row, Edinburgh.
1869. Gordon, James, Forester, 17 Avondale Place, Edinburgh.
1884. Gordon, James W., Assistant Forester, Balmoral, Ballater.
1881. Gorrie, Thomas, Assistant Forester, Logiealmond, Perth.
1880. Gough, William C., Assistant Forester, Wykeham, York.
1869. Gow, James, Forester, Logie Cottage, Airthrey, Stirling.
1875. Gow, Peter, Overseer, Laggan, Ballantrae, Ayrshire.
1882. Gow, Robt., Assistant Forester, Raith, Kirkcaldy, Fifeshire.
1878. *Gow, Thomas, Assistant Forester, Scone, Perth.*
1884. Gow, William, Assistant Forester, Pitfour, Aberdeenshire.
1870. *Grandison, James, Errol Park, Errol.*
1882. Grant, Alex. M'D., Assistant Forester, Hopetoun, South Queensferry.
1873. Grant, Colonel James A., C.B., C.S.I., 19 Upper Grosvenor Street, London, W.
1867. Grant, Donald, Forester, Drumin, Ballindalloch.
1876. Grant, David, Forester, Dalvey, Forres.
1873. Grant, James, Forester, Heath, Chesterfield.
1873. Grant, James, Assistant Forester, Abernethy, Strathspey.
1878. Grant, James, Assistant Forester, Drumpellier, Coatbridge.
1883. Grant, John, Assistant Forester, Balmoral, Ballater.
1875. Grant, John C., Forester, Portsoy, Banffshire.
1882. *Gray, James, Assistant Forester, Kelly, Wemyss Bay.*
1879. *Gray, Robert,* 15 *New Road, Newton-on-Ayr.*
1872. Green, Alex., Forester, Allanton House, Newmains, Lanarkshire.
1883. Green, Arthur A., 58 Broughton Street, Edinburgh.
1872. Greive, James, Messrs Dicksons & Co.'s Nurseries, Pilrig, Edinburgh.
1882. Grieve, Walter, Forester, Drygrange, Melrose.
1881. *Grigor, John, Assistant Forester, Rosehaugh, Killen, Ross-shire.*

1879. Haddington, the Right Hon. the Earl of, Tyninghame, Prestonkirk.
1880. Haddon, Walter, Solicitor, Royal Bank, Hawick.
1881. Hadfield, Gordon, Forest Department, Madras.
1882. Hamilton, Donald, Assistant Forester, 2 Alfred Place, Canonmills, Edinburgh.

Date of Election.

1873. Hamilton, John B. Baillie, of Arnprior, Cambusmore, Callander.
1880. Hamilton, Robert, Trinity Lodge, Trinity, Edinburgh.
1866. Hardie, Walter, Midburn, Elstree, Herts.
1880. Harlond, Henry, 15 Boscowen Place, Morice Town, Devonport.
1873. Harrower, William, Forester and Ground Officer, Carth, Aberfeldy.
1872. Hartland, Richard, The Lough Nurseries, Cork.
1882. Hattrick, James, Forester, Johnstone Castle, Renfrewshire.
1882. Haughs, David, Assistant Forester, Dupplin Castle, Perthshire.
1878. *Haugh, James, Assistant Forester, Colenden, Stormontfield, Perth.*
1860. Havelock, Thomas, Forester, Raby Park, Staindrop, Darlington.
1880. Havelock, W. B., Forester, Duncombe Park, Helmsley, York.
1882. Hay, Alex., 96 Constitution Street, Leith.
1869. Hayman, John, Overseer, Dumfries House, Cumnock.
1866. Henderson, Arch., Forester, Clonad Cottage, Tullamore, King's County.
1877. Henderson, George, Assistant Forester, Cavers Estate, Hawick.
1871. Henderson, John, Overseer, Vogrie, Ford, Dalkeith.
1883. Henderson, W., The Gardens, Balbirnie, Markinch.
1878. Henry, Kennedy, Forester, Hallyburton, Coupar-Angus.
1871. Hetherton, Walter, Forester, Merton, Beaford, Devon.
1873. Hilson, John, Forester, Ryther, Tadcaster, Yorks.
1882. Hodgart, James, Assistant Forester, Johnstone Castle, Renfrewshire.
1866. Hogarth, James, Forester, Culhorn, Stranraer.
1884. Hogg, Andrew, Assistant Forester, Jardine Hall, Lockerbie.
1866. Hogg, Thomas, Forester, Beau-Desert, Rugeley, Staffs.
1874. Home, Edward, Assistant Forester, Edington, Chirnside.
1872. Home, George, Assistant Forester, Bellstane, Drumlanrig, Thornhill.
1883. Homewood, Chas. E., Ufton Court, Sittingbourne, Kent.
1882. Hood, James, Assistant Forester, Freeland, Bridge of Earn, Perth.
1880. Hopetoun, The Right Hon. the Earl of, Hopetoun House, South Queensferry.
1864. Horsburgh, James, Forester, Yester, Haddington.
1882. Hoskins, Edward, Assistant Forester, Kinmel Park, Abergele, Wales.
1868. Howden & Co., The Nurseries, Inverness.
1876. Hull, Frank, Forester, Boughton Estate, Kettering, Northamptonshire.
1880. Hume, William, Iron and Wire Fence Manufacturer, 217 Buchanan Street, Glasgow.
1878. Hunter, James, Assistant Forester, Dalmeny Park, Edinburgh.
1880. Hunter, John, Forester, Duncrub Park, Dunning, Perthshire.
1884. Hunter, Wm., Forester, Drummond Castle, Muthill, Perthshire.
1873. Hussey, Samuel M., Estate Office, Tralee.
1881. Hutton, James, Forester, Glenormiston, Innerleithen, Peebles.

1880. Imrie, James, Forester and Land Steward, Rossie Castle, Montrose.
1884. Inch & Riddell, Seedsmen, Victoria Street, Edinburgh.
1882. Innes, Alex., Assistant Forester, Ruston, Brompton, York.
1884. Innes, Richard S., Upholsterer, 77 South Bridge, Edinburgh.
1870. Ireland & Thomson, Nurserymen and Seedsmen, Waterloo Place, Edinburgh.

Date of Election.

1875. Jackson, Magnus, *Photographer to the Society*, Princes Street, Perth.
1880. Jackson, Thomas, Princes Street, Perth.
1884. Jameson, Martin, Scone Estate Office, Balboughty, Perth.
1869. Jeffrey, James, Forester, Craighall, Blairgowrie.
1874. Johnston, George, The Gardens, Glamis Castle, Forfarshire.
1883. Johnston, Robert, Assistant Forester, Fryston Hall, Ferry Bridge, Yorkshire.
1870. Johnston, William, Forester, The Lee, Lanark.
1878. Johnstone, Adam, Forester, Coollattin, Shillelagh, County Wicklow, Ireland.
1882. Johnstone, Wm., Forester, Munches, Dalbeattie.
1868. Johnstone, W. W., Manager, Messrs F. & A. Dickson's Nurseries, Chester.

1867. Kay, James, Wood Manager, Bute Estate, Rothesay.
1880. Keay, Robert B., Forester, Redcastle, Inverness.
1865. Kedzie, Walter, Forester, Arundel, Sussex.
1878. *Keillor, John*, 18 *Clapperton Place, Sunnybank, Edinburgh.*
1870. Keir, David, Forester, Blair Athole, Perthshire.
1876. Kelman, John, Forester, Glenkindie, Aberdeen.
1883. Kemball, General Sir Arnold B., K.C.B., K.C.S.I., of Kembo, Uppat House, Golspie.
1882. Kennedy, John, Forester, Flakebridge, Appleby, Westmoreland.
1873. *Kennedy, John, Forester, Pitkerrald, Glen Urquhart, Drumnadrochit.*
1882. Kennedy, Walter, Forester, Skelbo, Dornoch.
1872. Kennedy, William, Overseer, Glen Carradale, Greenock.
1880. *Kerr, Wm. F., Assistant Forester, Blackwood, Lesmahagow.*
1870. Kidd, James B., Forester, The Poles, Dornoch.
1881. Kidd, William, Assistant Forester, Altyre, Forres.
1880. King, George, Forester, Dochfour, Inverness.
1866. Kinghorn, Adam, Forester, Rochsoles, Airdrie.
1883. Kinnear, Alex., Forester, Galloway House, Garlieston.
1878. Knight, Henry, Royal Gardens, Laeken, Brussels, Belgium.
1884. Knox, Henry, Forester, Brae Lodge, Maybole, Ayrshire.
1884. Kyrke, Arthur Venables, Chard, Somersetshire.
1884. Kyrke, Richard Henry Venables, of Nantyffrith, Wrexham, North Wales.
1876. Kyrke, R. V., of Penywern, Mold.

1885. Laird, James W., Nurseryman, 73 Nethergate, Dundee.
1865. Laird, R. B., & Sons, Nurserymen and Seedsmen, 17*a* Frederick Street, Edinburgh.
1881. Laird, William, Forester, Durris, Aberdeen.
1858. Lamont, John, sen., The Glen Nurseries, Musselburgh.
1873. Lauriston, Alexander, Woodman, Gorse Farm, Rufford, Ollerton, Notts.
1881. Lawrie, Robert, Manager, Glencasley, Invershin, Sutherland.
1880. Lees, John, Wood Manager, Archerfield, Drem.
1878. Lees, John, Manager, Rossmore Park, Monaghan, Ireland.
1877. Lees, William, Assistant Forester, Ardgowan, Greenock.

Date of Election.

1870. LEGGAT, Alexander, Forester, Vale Royal, Northwich, Cheshire.
1874. LEIGH, William, of Woodchester Park, Stonehouse, Gloucestershire.
1880. LEISHMAN, John, Forester, Cavers Estate, Hawick.
1880. *Lindsay, Alexander, Manager, Eythrope, Aylesbury, Bucks.*
1879. LINDSAY, Robert, Curator, Royal Botanic Garden, Edinburgh.
1884. *Lindsay Wm. Assistant Forester, Jardine Hall, Lockerbie.*
1868. LITTLE, Alexander, Forester, Relugas, Dunphail, Morayshire.
1883. LITTLE, William, Côte, St Antoine, Montreal, Canada.
1883. LOCH, Sir Henry B., K.C.B., Governor of Victoria, Australia.
1881. LOW, Joseph, Forester, Rothes, Leslie House, Fife.

1881. MACAULAY, James F., Forester, Castle Leod, Strathpeffer.
1876. *M'Bain, William, Forester, Clandeboye, County Down.*
1876. MACBEAN, John, Forester, Kinlochmoidart, Ardgour.
1872. M'COLL, James M., Factor, Craignish Castle, Lochgilphead, Argyleshire.
1882. M'CONOCHIE, Daniel, Forester, Houston, Johnstone.
1870. M'CORQUODALE, D. A., Bank of Scotland, Carnoustie.
1855. M'CORQUODALE, Donald, Forester, Dunrobin Castle, Golspie.
1882. *M'Creath, Walter, Assistant Forester, Kelly, Wemyss Bay.*
1869. M'CUTCHEON, Robert, Forester, Whittinghame, Prestonkirk.
1870. MACDONALD, Alexander, Forester, Balnagowan, Parkhill, Ross-shire.
1878. MACDONALD, Allan, Commissioner of Mackintosh Estates, 16 Union Street, Inverness.
1878. MACDONALD, Duncan, Manager, Mulroy, Carrigart, Letterkenny, Ireland.
1877. *M'Donald, James, Assistant Forester, Lynedoch, Perth.*
1881. M'DONALD, Peter, Assistant Forester, Bridgend, Islay.
1878. *M'Donald, Peter, Assistant Forester, Eglinton Castle, Irvine.*
1879. M'DOUGALL, Alex., Forester, Drumbuie Lodge, Dunkeld.
1880. M'EWIN, George, J.P., Glen Ewin, Houghton, South Australia.
1882. M'FARLANE, John, Forester, Tarbet, Loch Lomond.
. M'FARLANE, Walter, Assistant Gardener, Morton Hall, Edinburgh.
1881. M'GILP, John, Assistant Forester, Ardgowan, Greenock.
1882. M'GILLVRAY, George, Assistant Forester, Altyre, Forres.
1882. M'GLASHAN, David, Assistant Forester, Murthly Castle, Perthshire.
1871. M'GRATH, Patrick, Forester, Galtee Castle, Mitchelstown, Tipperary.
. MACGREGOR, Alex., Assistant Forester, Cross Roads, Aylesbury.
1876. *MacGregor, Alex., Forester, Lewis Castle, Stornoway.*
1881. M'GREGOR, Duncan, Assistant Forester, Abernethy, Strathspey.
1878. M'GREGOR, Duncan, Forester, Camperdown, Dundee.
1882. MACGREGOR, James G., Assistant Forester, Cally Mains, Gatehouse.
1876. M'GREGOR, Robert C., Forester, Tehidy Park, Camborne, Cornwall.
1866. M'HATTIE, John, Seedsman, Northgate, Chester.
1880. M'INTOSH, Angus, Forester, Llanerch, Llanelly, South Wales.
1875. M'INTOSH, Richard, Assistant Forester, Salton Hall, Pencaitland.
1885. MACINTOSH, William, 5 Thistle Street, Edinburgh.
1883. M'INTYRE, Alex., Assistant Forester, Craigengillan, Dalmellington, Ayrshire.
1882. M'INTYRE, John, Wood Merchant, Cardross, Dumbartonshire.

Date of Election.

1881. Mackay, George G., of Invergloy, Spean Bridge.
1881. Mackay, H., Timber Merchant, Shandwick, Nigg, Ross-shire.
1884. M'Kay, James, Forester, Breadalbane Estates, Killin.
1875. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1882. Mackenzie, Sir Alex. Muir, Bart. of Delvine, Dunkeld.
1881. M'Kenzie, Donald, Assistant Forester, Lynedoch, Perth.
1880. M'Kenzie, James, Assistant Forester, Sauchie, Stirling.
1883. M'Kenzie, James, Assistant Forester, Abernethy, Strathspey.
1867. Mackenzie, John Ord, of Dolphinton, W.S., 9 Hill Street, Edinburgh—*Auditor.*
1880. Mackenzie, Major, of Findon, Mount Gerald, Dingwall.
1882. Mackie, James H. J., Land Steward, Invermay, Dunning, Perthshire.
1880. M'Killop, Alexander, Forester, Castle Menzies, Aberfeldy.
1877. M'Kinnon, Alexander, The Gardens, Scone Palace, Perth.
1883. M'Kinnon, George, The Gardens, Melville Castle, Lasswade.
1877. M'Kinnon, John, The Gardens, Kylemore Castle, County Galway.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
1870. M'Laggan, John G., Forester, The Cairnies, Glenalmond, Perthshire.
1879. M'Laren, Charles, Land Steward, Cally Lodge, Dunkeld.
1868. M'Laren, John, Ballincrieff, Drem.
1854. M'Laren, John, Forester, Hopetoun House, South Queensferry.
1879. M'Laren, John, jun., 5 St Andrew Square, Edinburgh—*Secretary* and *Treasurer.*
1878. M'Laren, John T., Overseer, Kennet, Alloa.
. M'Laren, Peter, Forester, Lilleshall, Newport, Salop.
1866. M'Laren, Peter, Forester, Altyre, Forres.
1867. M'Lean, Andrew, Forester, Rutherford, Roxburgh.
1876. *M'Lean, John, Forester, 2 Alfred Place, Canonmills.*
1872. M'Lean, Malcolm, The Gardens, Vinters Park, Maidstone, Kent.
1866. M'Lean, William, Forester, Eglinton Castle, Irvine.
1883. Macleish, James, Hydraulic Engineer, Perth.
1865. M'Lellan, Duncan, Superintendent of Parks, 7 Kelvingrove Terrace, Glasgow.
1882. M'Lellan, Robt., 5 Dowan Vale Terrace, Partick.
1874. M'Leod, Angus A., Superintendent of City Gardens, 14 Royal Exchange, Edinburgh.
1884. MacLure, George, The Gardens, Trinity Grove, Edinburgh.
1885. M'Nicoll, Douglas, Estate Office, Mostyn, Holywell.
1881. Macrae, John, Forester, Higham, Bury St Edmonds.
1884. Main, Adam, Assistant Forester, Cluny Castle, Aberdeen.
1880. Marr, George, The Gardens, Hatton Castle, Turriff, Aberdeenshire.
1873. Marshall, Robert, Forester, Invercauld, Braemar, Aberdeenshire.
1871. Marshall, Robert, Bailiff, Kirklington Hall, Southwell, Notts.
1876. Martin, James, Forester, Stareton, Kenilworth, Warwickshire.
1884. Massie, William H., Knowefield Nurseries, Carlisle.
1885. Maxtone, John, Forester, Roseneath, Argyleshire.
. Maxtone, Robert, Forester, Castle Strathallan, Auchterarder.

Date of Election.

1879. Meikle, R. A., Agent for Lord Alington, Moor Crichel, Dorsetshire.
1873. Menzies, George, Agent, Trentham, Stoke-on-Trent.
1880. Menzies, Wm., Forester, Dissington, Newcastle.
1854. Methven, Thomas, & Sons, Nurserymen and Seedsmen, Leith Walk Nurseries, Edinburgh.
1865. Michie, Christopher Young, Forester, Cullen House, Banffshire.
1864. Michie, James, Forester, Wemyss Castle, East Wemyss, Fife.
1871. Middlemass, Archibald, Forester, Meikleour, Perthshire.
1880. *Miller, James W., Manager, Skibo Castle, Dornoch.*
1885. Milne, William, Forester, Urie House, Stonehaven.
1883. Milroy, Alex., Forester, Glencorse, Edinburgh.
1868. Mitchell, David, 6 Comely Bank, Edinburgh.
1884. Mitchell, David, Assistant Forester, Durris, Aberdeen.
1880. Mitchell, James, Forester, Fryston Hall, Ferry Bridge, Yorkshire.
1880. Mitchell, James, Assistant Forester, Airth Castle, Larbert.
1869. Mitchell, James, Aldie Castle, Kinross.
1876. Mitchell, James, Forester, Donibristle, Aberdour, Fife.
1876. Mitchell, John, Forester, Bolton Abbey, Skipton, Yorks.
1876. More, Robert, Forester, Hafton, Kirn, Argyleshire.
1876. Morgan, George, Wood Merchant, Turret Bank, Crieff.
1875. Morgan, Hugh, Wood Merchant, Crieff.
1877. Morrison, Alexander, Nurseryman, Elgin.
1877. Morrison, James, The Gardens, Archerfield, Drem.
1862. Morrison, John, Coney Park Nursery, Stirling.
1884. Morshead, Frank Upton Anderson, Salcombe Regis, Sidmouth, Devonshire.
1866. Muirhead, John, Forester, Bicton, Budleigh Salterton, Devonshire.
1876. Munro, Hugh, Forester, Holkham Hall, Norfolk.
1871. Munro, James, Assistant Forester, Darnaway Castle, Forres.
1883. Murdoch, James Barclay, Barclay, Langside, Glasgow.
1883. Murray, John, Assistant Forester, Murthly Castle, Perthshire.
1878. Murray, Robert R., Forester, Adare Manor, Co. Limerick.
1871. Myles, James, Forester, Kinnaird Castle, Brechin.

1882. Napier, Wm., Forester, Ballykelly, Londonderry.
1885. Newbigging, John W., Nurseryman, Dumfries.
1879. Newton, Robert P., of Castlandhill, Polmont Bank, Polmont.
1870. Nicol, William, Forester, Cluny Castle, Aberdeen.
1869. Nicol, W. R., Forester, Loudoun Castle, Galston.

1878. Ogilvie, David, Forester, The Guynd, Arbroath.
1882. Oliver, George, Assistant Forester, Snettisham, Kings Lynn.
1868. Ormiston & Renwick, Nurserymen and Seedsmen, Melrose.

1875. Page, Andrew Duncan, Land Steward, Culzean, Maybole.
1857. Palmer & Son, John, Nurserymen, Annan.
1857. Parker, James, Forester, Belvoir Castle, Grantham.
1856. Paterson, Andrew, Agent, Paultons, Romsey, Hampshire.
1885. Paterson, A. T., Steward, New Hall, Salisbury.

Date of Election.

1879. PATON, Hugh, Nurseryman, Kilmarnock.
1876. *Patton, Donald*, 1 *Livingstone Place, Edinburgh.*
1870. PEARSON, Joshua, Spirit Merchant, 14 Pitt Street, Glasgow.
1869. PEEBLES, Andrew, Estate Office, Albury, Guildford.
1871. PENDREIGH, John, Assistant Forester, Port Bannatyne, Rothesay.
1872. PHILIP, John, Wood Merchant, Bonnyrigg, Lasswade.
1882. PHILIP, Robt., Assistant Forester, Longleat, Horningsham, Wilts.
1878. PHILIPS, Alexander, Land Steward, Logiealmond, Perth.
1882. PHILLIPS, Alex., Assistant Forester, Balquhatson, Slamannan.
1878. PITCAITHLEY, Alexander, Forester, Glentruim, Kingussie.
1874. PLATT, Colonel Henry, Gorddinag, Langairfechan, near Bangor.
1877. PONSONBY, Charles John, Deputy-Conservator of Forests, Indian Forest Department, Baraitch, Oudh (12 Royal Circus, Edinburgh).
1872. *Powner, Thomas, Forester, Witley Court, Stourport, Worcestershire.*
1869. PRESSLY, David, Glenmaroon House, Chapelizod, Dublin.
1883. PRESTON, Wm. M., Vaynol Park, Bangor, Wales.
1881. *Proctor, John, Assistant Forester, Kelly, Wemyss Bay.*
1879. PRYKE, Walter, 1 Great Stanhope Street, Mayfair, London, W.
1878. PURDIE, Robert, Forester, Castle Blaney, County Monaghan, Ireland.
1875. PURVES, Alexander Paterson, W.S., 12 Queen Street, Edinburgh.

1876. RAE, James S., Forester, Dunipace House, Larbert.
1876. RAE, William Alexander, Durris Estate Office, Aberdeen.
1884. RAE, Wm., Forester, Kippenross, Dunblane.
1870. RATTRAY, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1854. RAVENSCROFT, Edward, 14 London Road, St John's Wood, London, N.W.
1876. *Ray, Andrew, Assistant Forester, Athronhall, Milnathort.*
1872. REID, James S., Overseer, Kerse Estate, Falkirk.
1881. REID, James, The Nurseries, Elgin.
1881. RIACH, John, Assistant Forester, Rosehaugh, Avoch, Ross-shire.
1873. RICHARDSON, Adam, Royal Botanic Garden, Edinburgh.
1880. *Riddall, David, Assistant Forester, Kintore.*
1877. RIDER, William H., 14 Bartholomew Close, London, E.C.
1876. RITCHIE, Alexander, Assistant Forester, Logiealmond, Perth.
1880. RITCHIE, Wm., Assistant Forester, Lynedoch, Perth.
1882. ROBERTSON, Alex., Assistant Forester, Eglinton Castle, Irvine.
1884. ROBERTSON, Alex., Assistant Forester, Dupplin Castle, Perth.
1879. ROBERTSON, Charles, Assistant Forester, Old Blair, Blair Athole.
1880. ROBERTSON, David M., Nurseryman, Trinity, Edinburgh.
1879. ROBERTSON, Donald, Forester, Novar, Evanton, Ross-shire.
1871. ROBERTSON, George, Overseer, Plean, Bannockburn.
1874. ROBERTSON, George, jun., Assistant Forester, Thirlestane Castle, Lauder.
1882. ROBERTSON, James, Assistant Forester, Baldornoch, Blairgowrie.
1881. ROBERTSON, John, Forester, Achnadrish, Tobermory.
1871. ROBERTSON, John, Forester, Minto House, Hawick.
1883. ROBERTSON, William, Assistant Forester, Murthly Castle, Perthshire.
1883. ROBERTSON, W. H., Forester, Loughcrew, Oldcastle, Co. Meath.
1883. ROBERTSON, Wm. M., Gardener, Rossdhu, Luss, Dumbartonshire.

Date of Election.

1869. Robertson, William W., Forester, Blinkbonny, Earlston.
1857. Robson, Alexander, Forester, Dochfour Woods, Lochend, Inverness.
1880. *Rodemer, Charles, Assistant Forester, Murthly Castle, Perthshire.*
1874. Ross, Arch., Overseer, Skipton Castle, Skipton-in-Craven, Yorkshire.
1880. Ross, James, Solicitor and Factor, Inverness.
1881. Ross, John, Assistant Forester, Balnagowan Castle, Ross-shire.
1882. *Ross, Lawson, Assistant Forester, Cavers, Hawick.*
1884. Ruddiman, Walter, Assistant Forester, Rothes Estate, Leslie, Fife.
1874. Rule, John, Forester, Monymusk, Aberdeenshire.
1867. Russell, John, Manager, Craigie House, Ayr.
1884. Russell, Thos., The Gardens, Keir House, Bridge of Allan.
1872. Rust, Joseph, The Gardens, Eridge Castle, Tunbridge Wells, Kent.
1865. Rutherford, Andrew, Agent, Shimblely Hall, Northallerton.
1870. Rutherford, John, Forester, Linthaugh, Jedburgh.

1858. Sandbach, Henry R., Hafodunos, Abergele.
1875. Sang, Edmund, Nurseryman and Seed Merchant, Kirkcaldy.
1879. Scaling, William, Willow Nurseryman, Basford, Notts.
1871. Scarth, T. W., Land Agent, Raby Castle, Staindrop, Darlington.
1870. Scott, Adam, Forester, Southwick Park, Fareham, Hants.
1881. Scott, Andrew, Assistant Forester, Foulis-Wester, Crieff.
1883. Scott, Andrew, Schoolmaster, Forgan, Newport, Fife.
1867. Scott, Daniel, Wood Manager, Darnaway Castle, Forres.
1883. Scott, David P., 9 Renny Place, Broughty Ferry.
1881. Scott, James, Forester, Woollerton, Notts.
1879. Scott, John, Forester, Curraghmore, Portlaw, Ireland.
1880. Scott, John T., 50 Phillip Street, Chester.
1880. Scott, Walter, Overseer, Cartland, Lanark.
1867. Scott, Walter, Forester, Oxnam, Jedburgh.
1883. Scott, William, Assistant Forester, Devonshaw, Dollar.
1870. Shanks, John, Forester, Kildrummy Castle, Mossat, Aberdeenshire.
1881. Sherrit, James, Jun., Assistant Forester, Idvies, Forfar.
1877. Shields, Robert, Assistant Forester, Keith Hall, Aberdeenshire.
1881. *Shuan, John, Assistant Forester, Killen, Ross-shire.*
1880. Sibbald, Thomas, Assistant Forester, Cavers Estate, Hawick.
1870. Sim, William, Nurseryman, Forres.
1874. Sime, John, Timber Merchant, Rafford, Forres.
1883. Simpson, James, Dalhousie Nurseries, Broughty Ferry.
1869. *Simpson, Peter, Forester, Limefield House, West Calder.*
1882. Sinclair, Peter, Wood Merchant, Perth.
1869. Sinton, James, Forester, Stourhead Estate, Stourton, Bath.
1872. Skeldon, John, Assistant Forester, Duns Castle, Duns.
1868. Slater, Andrew, Overseer, Haystoun, Peebles.
1869. Smith, Andrew, Factor, Castlemains, Douglas, Lanarkshire.
1880. Smith, David, Forester, Woodend, Rosslyn.
1873. Smith, G. B., Wire Fence Manufacturer, 61 West Regent St., Glasgow.
1883. *Smith, Henry, Assistant Forester, Kailzie Estate, Peeblesshire.*
1871. Smith, James, The Gardens, Mentmore, Leighton-Buzzard, Bucks.

Date of Election.

1883. Smith, James, The Gardens, Moredun, Liberton, Edinburgh.
1875. *Smith, John, care of R. Smith & Co., St John's Nurseries, Worcester.*
1870. Smith, John Crombie, Forester, Portmore, Eddleston, Peebles.
1884. Smith, John Edward, Timber Buyer, 219 Rushton Road, Thornbury, near Bradford.
1870. Smith, Thomas, Nurseryman and Seedsman, Stranraer.
1869. *Smith, W. Baxter, 3 Broadlands, South Norwood, London.*
1883. Smith, William, Chemist, Stockbridge, Edinburgh.
1883. Smith, W., & Son, Patentees of the Celyddon Wire Fence, Inverness.
1878. Sothern, Peter, Forester, Broomhall, Dunfermline.
1884. Spiers, David, Overseer, Mugdrum, Newburgh, Fife.
1884. Sprot, Colonel John, of Riddell, Lilliesleaf, Roxburghshire.
1882. Stalker, Donald, Forester, Murthly Castle, Perthshire.
1864. Stapylton, Major, Myton Hall, Boroughbridge, Yorkshire.
1874. Stark, John, Forester, Springkell, Ecclefechan, Dumfries.
1873. Stephen, John, Forester, Abernethy, Strathspey.
1880. *Stephens, Wm., Assistant Forester, Scone, Perth.*
1868. Stewart, Alexander, Agent, Bodnaut Estate, Conway, N. Wales.
1870. Stewart, John, Overseer, Abington, Lanarkshire.
1882. Stewart, John, Forester, Inveraray Castle, Argyleshire.
1875. Stewart, J. M., Cherry Tree Cottage, Nusworth, Whitefield, near Manchester.
1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1864. Stewart, William, Land Steward, Dalhousie Castle, Lasswade.
1876. Stirling, John, Forester, Cally Mains, Gatehouse of Fleet.
1876. Stuart, Charles, Forester, Glenmoriston, Inverness.
. *Stuart, John, Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.*
1878. Stuart, John, Wood Manager, Castle Grant, Grantown, Strathspey.
1868. *Stuart, Lewis A. G., Durris Estate, Aberdeenshire.*
1867. Stuart & Mein, Nurserymen, Kelso.
1876. Sturrock, David, Assistant Forester, Panmure, Carnoustie.
1878. Sturrock, William, Assistant Forester, Wemyss Castle, Dysart, Fife.
1883. Sturt, W. Neville, Union Club, London.
1883. Swan, James, Assistant Forester, Cavers, Hawick.
1872. Swan, R. G., Auctioneer, Duns.
1873. Swinton, A. Campbell, LL.D., F.R.S.E., of Kimmerghame, Duns.
1884. Syme, David, Manager, Peter Lawson & Son, Limited, Edinburgh.
1869. Symon, John, Forester, Cawdor Castle, Nairn.
1870. Symon, Peter, Town's Forester, Forres.

1869. Tait, David, Forester, Owston Park, Doncaster, Yorkshire.
1871. Taylor, David, Overseer, Barskimming, Mauchline.
1882. Taylor, William, Assistant Forester, Dupplin Castle, Perthshire.
1883. Thomson, Alex., Assistant Forester, Murthly Castle, Perthshire.
1884. Thomson, B. Lumsden, 85 Gracechurch Street, London.
1884. Thomson, Charles, Assistant Forester, Jardine Hall, Lockerbie.
1879. Thomson, George B., Forester, Blenheim Park, Woodstock, Oxfordshire.
1869. Thomson, Lockhart, S.S.C., 114 George Street, Edinburgh.

Date of Election.

1871. Tomlinson, Wilson, Forester, Clumber Park, Worksop, Notts.
1881. Tulloch, Donald, Assistant Forester, Abernethy, Strathspey.
1882. Turnbull, John, Overseer, Brayton Hall, Carlisle.

1882. Ulyatt, Thomas, Assistant Forester, Rufford, Ollerton, Newark, Notts.
1883. Underwood, Henry E., Sub-Agent, Fornham, St Genevieve, Bury St Edmunds, Suffolk.

1878. Veitch, Charles, Assistant Forester, Portmore, Eddleston, Peebles.
1882. Veitch, James B., Kakiacherra, Balisera Tea Estate, Matigunj, Sylhet, India.

1873. Walker, George, Forester, Balgonie, Markinch, Fife.
1879. Walker, John, Assistant Forester, Rossdhu, Luss, Dumbartonshire.
1870. Wall, G. Young, Land Agent, Grange House, Darlington.
1881. Watson, Charles, Writer, Duns.
1871. Watson, John, Gardener, Stravithie, St Andrews.
1879. Watson, John, of Earnock, Hamilton.
1872. Watt, James, of Little & Ballantyne, Nurserymen, Carlisle.
1871. Watt, William, Forester, Nisbet House, Duns.
1874. Webster, Angus D., Forester, Penrhyn Castle, Bangor, North Wales.
1872. Webster, John, The Gardens, Gordon Castle, Fochabers.
1880. *Weir, George, Leith Walk Nurseries, Edinburgh.*
1866. Welsh, William M., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1882. Wemyss, Baillie, 23 Brunton Place, London Road, Edinburgh.
1882. West, J. R., Forester, Fonthill Abbey, Tisbury, Wilts.
1880. Westwood, Wm., Manager, Belladrum, Beauly.
1881. *Whan, Alexander, Assistant Forester, Cally Mains, Gatehouse of Fleet.*
1881. Whitson, A., Assistant Forester, The Nurseries, Rufford, Ollerton,
1883. Whitton, Peter, The Gardens, Methven Castle, Perth.
1884. Whitton, James, The Gardens, Coltness, Wishaw.
1884. Whyte, John, Assistant Forester, Camperdown, Dundee.
1883. Wilkie, Charles, Assistant Forester, Lennoxlove, Haddington.
1875. Wilkie, Thos., Forester, Haddington Estates, Tyninghame, Prestonkirk.
1882. Williamson, A., Wood Manager, Eridge Castle, Tunbridge Wells, Kent.
1867. Wilson, John, Forester, Doonpark, Dalbeattie.
1871. Wilson, John, Forester, Greystoke Castle, Penrith.
1872. Wilson, John, Forester, Sudbourne Hall, Wickham Market, Suffolk.
1882. Wilson, Robt., Forester, Law's Cottage, Duns.
1883. Winning, John G., Estate Office, Branxholm, Hawick.
1868. Wyllie, George, Ballogie, Aboyne, Aberdeenshire.
1884. Wyton, William, The Gardens, Heysham Hall, Lancashire.

1875. Young, William, Forester, Lennoxlove, Haddington.

ABSTRACT of the ACCOUNTS of the SCOTTISH ARBORICULTURAL SOCIETY for YEAR 1884-85.

BRANCH	CHARGE.			
I.	Drawn from Capital Account,	£100	0	0
II.	Arrears of Subscriptions received,	52	9	0
III.	Amount of Subscriptions received,	115	4	0
IV.	Sums received for Life Membership,	34	13	0
V.	Sums received for Advertisements in the Society's Publications,	27	0	0
VI.	Dividend on Bank of Scotland Stock, October 1884 and April 1885,	14	0	0
VII.	Donations,	4	0	0
VIII.	Miscellaneous receipts,	0	5	0
IX.	Interest on Capital Account with National Bank,	0	18	0
	Amount of Charge,	£348	9	0

BRANCH	DISCHARGE.			
I.	Prizes paid in money,	£2	0	0
II.	Salary to Secretary and Treasurer,	40	0	0
III.	Accounts paid,	259	7	3
IV.	Incidental Expenses,	6	14	6
V.	Proportion of Life Subscriptions paid into Capital Account with National Bank, with interest,	24	0	0
VI.	Balance of Operations on Current Account with National Bank,	16	7	3
	Amount of Discharge equalling Charge,	£348	9	0

STATE of the FUNDS as at 2d AUGUST 1885.

Sinking Fund, being price paid for One Share Bank of Scotland Stock, and expenses of Transfer,	£327	5	0
Amount of Capital Account with National Bank, including interest to 2d August 1885,	4	14	8
Balance in Bank Current Account,	13	10	5
Nett Funds of the Society,	£345	10	1

Edinburgh, 4th August 1885.—I have examined the foregoing Account of Mr John M'Laren, Junior, as *Treasurer* of the Scottish Arboricultural Society, for year 1884-85, and find the same to be correctly stated and sufficiently vouched. The total Funds of the Society are, as per State of Funds, £345, 10s. 1d.

JOHN ORD MACKENZIE, *Auditor*.

APPENDIX (C.)

Scottish Arboricultural Society.

PATRON—HER MOST GRACIOUS MAJESTY THE QUEEN.

1.—FORMER PRESIDENTS.

YEAR.		MEMBERS.
1854-55.	JAMES BROWN, Deputy-Surveyor of the Royal Forest of Dean,	35
1855-56.	Ditto, Wood Commissioner to the Earl of Seafield,	59
1856-57.	Ditto, ditto,	92
1857-58.	The Right Hon. THE EARL OF DUCIE,	142
1858-59.	The Right Hon. THE EARL OF STAIR,	167
1859-60.	Sir JOHN HALL, Bart., of Dunglass,	170
1860-61.	His Grace THE DUKE OF ATHOLE,	182
1861-62.	JOHN J. CHALMERS of Aldbar,	159
1862-63.	The Right Hon. THE EARL OF AIRLIE,	163
1863-64.	The Right Hon. T. F. KENNEDY,	151
1864-65.	ROBERT HUTCHISON of Carlowrie, F.R.S.E.,	162
1865-66.	Ditto, ditto,	168
1866-67.	Ditto, ditto,	220
1867-68.	Ditto, ditto,	284
1868-69.	Ditto, ditto,	367
1869-70.	Ditto, ditto,	464
1870-71.	Ditto, ditto,	549
1871-72.	Ditto, ditto,	612
1872-73.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie,	658
1873-74.	Ditto, ditto,	665
1874-75.	JOHN HUTTON BALFOUR, M.D., M.A., F.R.SS.L. & E., Professor of Botany in the University of Edinburgh,	681
1875-76.	Ditto, ditto,	698
1876-77.	The Right Hon. W. P. ADAM of Blairadam, M.P.,	731
1877-78.	Ditto, ditto,	750
1878-79.	Ditto, ditto,	730
1879-80.	The Most Hon. THE MARQUIS OF LOTHIAN, K.T.,	732
1880-81.	Ditto, ditto,	740
1881-82.	Ditto, ditto,	745
1882-83.	ALEXANDER DICKSON, M.D., F.R.S.E., of Hartree, Regius Professor of Botany in the University of Edinburgh,	693
1883-84.	HUGH CLEGHORN, M.D., LL.D., F.R.S.E., of Stravithie,	756
1884-85.	Ditto, ditto,	772
1885-86.	Ditto, ditto,	743

2.—LIST OF MEMBERS.

Corrected to June 1887.

The Names of Members whose present Address is not known to the Secretary are printed in italics.

Law V. Members in arrear shall not receive the *Transactions* while their Subscriptions remain unpaid. Any Member whose Annual Subscription to the Society remains unpaid for three years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till he shall have paid up his arrears.

Date of Election.

HONORARY MEMBERS.

1873. Brandis, Sir Dietrich, K.C.S.I., Ph.D., *Ex*-Inspector-General of Forests in India, Bonn, Germany.
1868. Bullen, Robert, Curator of the Botanic Garden, Glasgow.
1886. Campbell, Sir James, Bart., Whitemead Park, Lydney, Gloucestershire.
1865. Cleghorn, Hugh, M.D., LL.D., F.R.S.E., Stravithie, St Andrews, Fife (also a *Life* Member by composition).
1879. Dickson, Alex., M.D., F.R.S.E., of Hartree, Regius Professor of Botany, University of Edinburgh (11 Royal Circus).
1886. Hooker, Sir Joseph D., M.D., K.C.S.I., The Camp, Sunningdale, Berks.
1864. Hutchison, Robert, F.R.S.E., of Carlowrie, 29 Chester St., Edinburgh.
1886. Jack, Edward, St John, New Brunswick.
1886. Johore, The Maharajah of, Johore, Malay Peninsula.
1856. Lawson, George, LL.D., Ph.D., Professor of Natural History and Chemistry, Dalhousie College, Halifax, Nova Scotia.
1869. Lothian, The Most Hon. the Marquis of, K.T., Newbattle Abbey, Dalkeith (also a *Life* Member by composition).
1886. Lubbock, Sir John, Bart., M.P., D.C.L., High Elms, Down, Kent.
1854. M'Corquodale, William, Forester and Wood Surveyor, Jeanie Bank, Perth (also a *Life* Member by composition).
1886. Michael, General, C.S.I., Ascot.
1886. Russell, Hon. William, Demerara.
1886. Southey, Hon. Robert, Cape Town.
1881. Temple, Sir Richard, Bart., G.C.S.I., The Nash, Worcestershire.
1886. Tokai, Tokio, Japan.

Date of Election.

LIFE MEMBERS.

1875. Acland, Sir Thomas Dyke, Bart., M.P., of Killerton, Exeter.
1883. Adam, Sir Charles Elphinstone, Bart. of Blairadam, Kinross-shire.
1883. Alexander, John, Kirklees, Uda Pusalawa, Ceylon.
1883. Athole, His Grace the Duke of, K.T., Blair Castle, Blair Athole.
1884. Balfour of Burleigh, The Right Hon. Lord, Kennet House, Alloa.
1886. Balfour, Edward, of Balbirnie, Markinch, Fife.
1877. Balfour, Isaac Bayley, Sc.D., M.D., F.L.S., Professor of Botany, Oxford.
1866. Barrie, James, Forester, Stevenstone, Torrington, North Devon.
1884. Bates, Cadwallader John, of Heddon and Langley Castle, Northumberland.
1871. Bell, William, of Gribdae, Kirkcudbright.
1875. Bertram, William, Ellengowan Villa, Newington, Edinburgh.
1877. Bolckow, C. F. H., of Brackenhoe, Middlesboro'-on-Tees.
1881. Brodie of Brodie, Brodie Castle, Forres.
1882. Bruce, Hon. Robert Preston, M.P., Broomhall, Dunfermline.
1871. Bruce, Hon. T. C., 24 Hill Street, Berkeley Square, London, W.
1867. Bruce, Thomas Rae, of Slogarie, New Galloway Station.
1879. Buccleuch, His Grace the Duke of, K.T., Dalkeith Park, Dalkeith.
1882. Chowler, Christopher, Gamekeeper, Dalkeith Park, Dalkeith.
1877. Clay, J. Spender, Ford Manor, Lingfield, Surrey.
1872. Clerk, Sir George D., Bart., Penicuik House, Penicuik.
1879. Colquhoun, Andrew, Forester, Rossdhu, Luss, Dumbartonshire.
1876. Cowan, Charles W., younger of Logan House, Valleyfield, Penicuik.
1875. Craig, Wm., M.D., C.M., F.R.S.E., 7 Bruntsfield Place, Edinburgh.
1865. Crawford, William Stirling, of Milton, Glasgow.
1865. Cross, David G., Forester, Kylisk, Nenagh, Ireland.
1880. Cumberbatch, L. H., Holt Cottage, Brockenhurst, Hants.
1880. Curr, Henry, Factor, Pitkellony House, Muthill, Perthshire.
1884. Currie, Sir Donald, K.C.M.G., M.P., of Garth Castle, 13 Hyde Park Place, London, W.
1867. Dalgleish, John J., of Ardnamurchan, 8 Athole Crescent, Edinburgh.
1876. Dalgleish, Laurence, of Dalbeath, 8 Athole Crescent, Edinburgh.
1882. Dalhousie, The Right Hon. The Earl of, K.T., Brechin Castle, Brechin.
1877. Dewar, Daniel, Forester, Beaufort Castle, Beauly.
1871. Duncan, Alexander, of Knossington Grange, Oakham, Leicestershire.
1875. Duncan, James, of Benmore, Kilmun, Greenock.
1883. Dundas, Charles H., of Dunira, Dalhonzie, Crieff.
1872. Dundas, Robert, of Arniston, Gorebridge.
1875. Eastwood, James, The Gardens, Bryn-y-Newadd, Bangor, North Wales.
1876. Edwards, William Peacock, S.S.C., 21 Hill Street, Edinburgh.
1881. Elliot, Walter, Manager, Ardtornish, Morvern, Oban.
1879. Falconer, Dr John, St Ann's, Lasswade.
1869. Fish, D. T., Hardwick House, Bury St Edmunds.
1874. Fitzwilliam, The Right Hon. the Earl, K.G., Wentworth, Rotherham, Yorkshire.
1885. Fleming, J. B., "Beaconsfield," Kelvinside, Glasgow.
1881. Forbes, Arthur Drummond, Millearne, Auchterarder, Perthshire.

Date of Election.

1866. France, Charles S., 35 Market Street, Aberdeen.
1856. Gough, William, Wood Manager, Wykeham, York.
1884. Graham, Wm., of Erins, Tarbert, Lochfyne.
1880. Grant, Sir George Macpherson, Bart., M.P., Ballindalloch Castle, Banffshire.
1874. Grant, John, Overseer, Daldowie, Tollcross.
1867. Grimond, Alexander D., of Glenericht, Blairgowrie.
1880. Hare, Colonel, Philpstoun House, Philpstoun.
1874. Herbert, H. A., of Muckross, Killarney.
1884. Heywood, Arthur, Sudbourne Hall, Wickham Market, Suffolk.
1871. Hope, H. W., of Luffness, Drem.
. Horne, John, Director, Forests and Gardens, Mauritius, per Messrs Richardson & Co., 13 Pall Mall, London, W.C.
1876. Horsburgh, John, Photographist and Portrait Painter, 131 Princes Street, Edinburgh.
1874. Hubbard, Egerton, M.P., of Addington Manor, Winslow, Bucks.
1869. Huth, Louis, of Possingworth, Hawkhurst, Sussex.
Hutton, James, Bankfoot, Perth.
1884. Inglis, Alex., Breadalbane Estate Office, Aberfeldy.
1866. Jeffrey, John, of Balsusney, Kirkcaldy, Fife.
1880. Jenner, Charles, Easter Duddingston Lodge, Edinburgh.
1882. Jonas, Henry, Land Agent and Surveyor, 4 Whitehall, London, S.W.
1876. Leicester, The Right Hon. the Earl of, Holkham Hall, Wells, Norfolk.
1868. Leslie, Charles P., of Castle-Leslie, Glasslough, Ireland.
1874. Leslie, The Hon. George Waldegrave, Leslie House, Leslie, Fife.
1883. Loney, Peter, Estate Agent, Marchmont, Duns.
1881. Lonsdale, Claud, Rose Hill, Carlisle.
1880. Lovat, The Right Hon. Lord, Beaufort Castle, Beauly.
1880. Love, J. W., care of Mrs J. Boyce, Semaphore, Lefevre's Peninsula, South Australia.
1875. Lovelace, The Right Hon. the Earl of, East Horsley Towers, Woking Station, Surrey.
1881. Lumsden, David, of Pitcairnfield, Perth.
1875. Luttrell, George F., of Dunster Castle, Taunton, Somersetshire.
1874. Macdonald, Ranald, Factor, Cluny Castle, Aberdeenshire.
1876. M'Dougall, Captain J. W., jun., of Orchill, Braco, Perthshire.
1884. Macduff, Alex., of Bonhard, Perth.
1868. M'Gregor, John, Forester, Ladywell, Dunkeld, Perthshire.
1879. M'Intosh, Dr W. C., Professor of Natural History, University of St Andrews, 2 Abbotsford Crescent, St Andrews.
1882. M'Kenzie, Alex., Superintendent of Epping Forest, The Warren, Loughton, Essex.
1869. Mackenzie, Colin, J., of Portmore, Eddleston, Peebles.
1872. Mackenzie, Donald F., Estate Office, Morton Hall, Edinburgh.
1880. Mackenzie, Sir Kenneth, Bart., Conon House, Dingwall.
1879. M'Laren, John, jun., *Secretary* and *Treasurer*, 5 St Andrew Square, Edinburgh.
1879. MacRitchie, David, C.A., 4 Archibald Place, Edinburgh.
1857. MacTier, A. W., "Rothesay," Bournemouth, Hants.

Date of Election.

1880. Malcolm, Lieut.-Col. E. D., R.E., 18 Queen's Gate Place, London, S.W.
1871. Maxwell, Wellwood H., of Munches, Dalbeattie.
1880. Mesham, Captain, Pontryffydd, Bodvari, Rhyl.
1881. Michie, John, Forester, Balmoral, Ballater.
1858. Minto, The Right Hon. the Earl of, Minto House, Hawick.
1882. Mitchell, Francis, Forester, Warwick Castle, Warwick.
1881. Naylor, Christopher John, Brynellywarch, Kerry, Montgomeryshire.
1883. Paton, Chalmers Izett, of Belstane, Kirknewton.
1856. Portsmouth, The Right Hon. the Earl of, Eggesford, North Devon.
1878. Punchard, Frederick, Underley Estate Office, Kirkby Lonsdale, Westmoreland.
1855. Ramsden, Sir John, Bart., 6 Upper Brook Street, London, W.
1874. Ridley, G., 2 Charles Street, Berkeley Square, London, W.
1876. Ritchie, William, of Middleton, Gorebridge, Edinburgh.
1866. Robertson, James, Wood Manager, Panmure, Carnoustie.
1883. Rollo, The Hon. Wm. Chas. Wordsworth, Master of Rollo, Duncrub Park, Dunning, Perthshire.
1872. Rosebery, The Right Hon. the Earl of, Dalmeny Park, Edinburgh.
1871. Rosslyn, The Right Hon. the Earl of, Dysart House, Fife.
1854. Rutherford, James, Agent, Kirkleatham, Redcar, Yorkshire.
1877. Smith, Thomas Valentine, of Ardtornish, Morvern, Argyleshire (111 Grosvenor Road, London, S.W.).
1882. Smythe, David M., yr. of Methven Castle, Perth.
1883. Sprot, Captain Alexander, of Garnkirk.
1883. Stafford, The Most Hon. the Marquis of, M.P., Dunrobin Castle, Golspie.
1873. Stair, The Right Hon. the Earl of, Lochinch, Castle Kennedy, Wigtownshire.
1883. Stormont, The Right Hon. Viscount, Scone Palace, Perth.
1880. Sutherland, Evan C., of Skibo Castle, Dornoch.
1865. Talbert, Peter, Forester, Glenericht, Blairgowrie.
1877. Terris, James, Factor, Dullomuir, Blairadam, Kinross-shire.
1880. Thomson, Alexander, 35 Chester Street, Edinburgh.
1855. Thomson, John Grant, Wood Manager, Grantown, Strathspey.
1883. Trotter, Colonel H., of Morton Hall, Edinburgh.
1872. Trotter, Colonel, R.A., The Bush, Edinburgh.
1878. Turnbull, John, of Abbey St Bathans, 49 George Square, Edinburgh.
1872. Urquhart, B. C., of Meldrum, Aberdeenshire.
1878. Walker, Major I. Campbell, Conservator of Forests, Forest Office, Madras.
1872. Wemyss, Randolph Gordon Erskine, of Wemyss and Torrie, Fife.
1869. Wild, Albert Edward, Conservator of Forests, Punjab, India (care of W. Wild, Wath-upon-Dearne, Rotherham, Yorkshire).
1861. Wilson, John, F.R.S.E., Professor of Agriculture, University, Edinburgh.

ORDINARY MEMBERS.

1882. Ahlbottn, Nathaniel, Tree Protective Composition Manufacturer, 50 Shore, Leith.
1856. Airlie, The Right Hon. the Earl of, Cortachy Castle, Forfarshire.

Date of Election.

1878. Aitken, Andrew Peebles, M.A., Sc.D., Professor of Chemistry, Veterinary College, Clyde Street, Edinburgh.
1872. Alexander, James, of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1883. *Allan, Alex., Forester, Mitchelstown Castle, County Cork.*
1865. Allan, John, Forester, Dalmeny Park, Edinburgh.
1882. Allan, Thomas G., Ironmonger, Helensburgh.
1869. Anderson, Alexander, Forester, St Fort, Newport, Dundee.
1869. Anderson, Alexander, Gardener, Musselburgh.
1883. Anderson, David, Assistant Forester, Inver, Dunkeld.
1880. Anderson, George, Timber Merchant, Bonar Bridge.
1883. Anderson, Hector, Assistant Forester, Ardross, Alness, Ross-shire.
1883. Anderson, James, Forester, Early Wood, Bagshot, Surrey.
1881. Anderson, Peter, Forester, Dupplin Castle, Perth.
1881. Anderson, Thomas R., Assistant Forester, Idvies, Forfar.
1872. Annandale, Robert B., Adderley Lodge, Market Drayton, Shropshire.
1871. Archer, James, Forester, Woodstock, Inistiogue, County Kilkenny.
1867. *Archibald, Thomas, Forester, Monkwray, Whitehaven, Cumberland.*
1883. Argyll, His Grace the Duke of, K.T., LL.D., D.C.L., F.R.S., F.G.S., Inverary Castle, Argyleshire.
1860. Austin & M'Aslan, Nurserymen and Seedsmen, Buchanan St., Glasgow.

1877. Bain, W. P. C., Lochrin Ironworks, Lower Gilmore Place, Edinburgh.
1880. Baines, W. M., of Bell Hall, York.
1880. Balden, John, Dilston, Corbridge-on-Tyne, Northumberland.
1880. Balden, Robert S., Wood Manager, Castle Howard, York.
1886. Balfour, John, of Balbirnie, Markinch, Fife.
1877. Barclay, David, Forester, Routenburn, Largs, Ayrshire.
1884. Barrett, Robert Bell, Estate Agent, Skipton Castle, Skipton, Yorkshire.
1867. Barrie, David, Forester, Comlongan Castle, Annan.
1882. Barrie, John, Land Steward, Gateforth Hall, Selby, Yorkshire.
1886. Barron, James, The Gardens, Meldrum House, Aberdeen.
1877. Barry, John W., of Fylingdales, Whitby.
1874. Barton, James, Forester, Hatfield House, Herts.
1871. Baxter, Robert, Forester, Dalkeith Park, Dalkeith.
1858. Baxter, William, Forester, Dunrobin, Golspie.
1870. Bayne, Lewis, Forester, Kinmel Park, Abergele, North Wales.
1878. Bell, Andrew, Assistant Forester, Yester, Haddington.
1883. Bell, Andrew, Forester, Broomhall, Charlestown, Fife.
1866. Bell, James, The Gardens, Stratfieldsaye, Winchfield, Hants.
1884. Bell, Robert, The Gardens, Morton Hall, Liberton, Edinburgh.
1884. Bett, Thomas, Factor, Portbane, Kenmore, Aberfeldy.
1869. Birch, John, The Gardens, Windlestone Hall, Ferry Hill, Durham.
1869. Bissett, William S., Overseer, Moncrieffe House, Perth.
1883. Blake, Jas., Forester, Morton Hall, Edinburgh.
1869. Boa, Andrew, Land Steward, Dalton House, Newcastle-on-Tyne.
1872. Boa, Andrew, jun., Sub-Agent, Great Thurlow, Newmarket, Suffolk.
1876. Booth, John, of Flottbeck Nurseries, Hamburg.
1857. Borthwick, William, Forester, Dunnichen, Forfar.

Date of Election

1882. Boss, John, Jun., Assistant Forester, Hopetoun, South Queensferry.
1883. Boyd, John, Assistant Forester, Kilmahew, Cardross.
1860. Brodie, James, Land Steward, Glasslough, Armagh, Ireland.
1880. Brodie, Thomas D., W.S., 5 Thistle Street, Edinburgh.
1881. Brodie, Vernon Alex., Civil Service, Madras.
1880. Brotherston, R. P., The Gardens, Tyninghame, Prestonkirk.
1886. Brown, Alexander, Nurseryman, Millport, Bute.
1874. *Brown, Andrew, Assistant Forester, Portmore, Eddleston.*
1879. *Brown, George E., Forester, Cumloden, Newton-Stewart.*
1878. Brown, J. A. Harvie, of Quarter, Dunipace House, Larbert.
1883. Brown, John E., F.L.S., Conservator of Forests, Forest Board Office, Adelaide, South Australia.
1878. Brown, Robert, Forester, Blackwood, Lesmahagow.
1884. Brown, Thomas, Forester, Craigingillan, Dalmellington.
1883. Browning, John, The Gardens, Dupplin Castle, Perth.
1885. Bruce, Thomas, Assistant Forester, Cross Roads, Kinnell, Friockheim.
1870. Bryan, F. G. D., Factor, Drumpellier, Coatbridge.
1873. Brydon, John, Forester, Rothes, Elgin.
1873. Buchan, Alexander, A.M., F.R.S.E., Secretary of the Scottish Meteorological Society, 72 Northumberland Street, Edinburgh.
1877. Buchan, William, Forester, Grangemuir, Pittenweem, Fife.
1879. Buchanan, Charles, Overseer, Penicuik House, Penicuik.
1865. Buchanan, Robert R., Forester, Duns Castle, Duns.
1880. Buddicom, W. B., Penbedw, Mold, Flintshire.
1875. Burgess, William, Forester, Drumpellier, Coatbridge.
1884. Burrows, Alfred J., F.S.I., F.L.S., Land Steward, Pluckley, Kent.

1870. Cameron, Alexander, Forester, Countlich Lodge, Ballinluig, Perthshire.
1881. *Cameron, Alex., Assistant Forester, Gask, Perth.*
1876. *Cameron, Donald, 9 Canon Street, Canonmills, Edinburgh.*
1879. *Cameron, H. W., Forester, Roschaugh, Killen, Ross-shire.*
1881. *Cameron, Joseph, Assistant Forester, Rosehaugh, Killen, Ross-shire.*
1866. Cameron, Robert, Forester, Pale, Corwen, North Wales.
1867. Campbell, Alexander, Forester, Old Manse, Liff, Dundee.
1882. Campbell, Alex., Assistant Forester, Murthly, Perthshire.
1865. Campbell, James, of Tillichewan Castle, Dumbartonshire.
1883. Campbell, John Macnaught, Assistant Curator, City Museum, Kelvingrove Park, Glasgow.
1878. Cantley, N., Superintendent, Botanical Gardens, Singapore.
1870. Chaplain, George, Assistant Forester, Glamis Castle, Forfarshire.
1867. Chirnside, Francis, Forester, Ladykirk, Berwickshire.
1884. Christie, Alex. D., The Gardens, Warwick Castle, Warwickshire.
1883. Christie, William, Nurseryman, Fochabers.
1871. Churnside, Robert, Forester, Edlingham, Alnwick.
1872. Clark, David, Forester, Elie House, Elie, Fife.
1866. Clark, James, Forester, Balvaird Cottage, Strathmiglo, Fife.
1867. Clark, John, Ground Officer, Keith Hall, Aberdeenshire.
1867. Clark, John, Forester, Kelly, Wemyss Bay.
1882. *Clark, Wm., Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.*

Date of Election.

1870. Cobban, John, Wood Agent, Wentworth Woods, Rotherham, Yorks.
1869. Cockburn, William, Forester, Willowbank, Penicuik.
1867. Cocker, James, The Nurseries, Sunnypark, Aberdeen.
1882. Collins, Robt. T., Forester, Trentham, Stoke-on-Trent, Staffordshire.
1869. Corbett, James, Forester, Underley Hall, Kirkby Lonsdale, Westmoreland.
1877. Corbett, John, Forester, Dallam Tower, Milnthorpe, Westmoreland.
1876. Coupar, George, 24 St Andrew Square, Edinburgh.
1879. Coupar, Robert, Forester, Ashford, Cong, County Galway.
1858. Cowan, James, Forester, Bridgend, Islay.
1872. Cowie, John, Assistant Forester, Mountstuart, Rothesay.
1874. Cowper, R. W., Assistant Agent, 81 High Street, Sittingbourne.
1875. Crabbe, David, Forester, Cortachy Castle, Kirriemuir.
1867. Crabbe, James, Forester, Glamis Castle, Forfarshire.
1880. Crawhall, George, Burton Croft, York.
1882. Crearer, John, Assistant Forester, Scone, Perth.
1876. Cromb, James, Assistant Forester, Kelly Castle, Arbirlot, Arbroath.
1873. Crosbie, John, Forester, Ballindalloch Castle, Banffshire.
1873. Cumming, Donald, Lynwilg Hotel, Aviemore, Inverness-shire.
1884. Cumming, John, Assistant Forester, Nonyes Cottages, Davyhulme, Stretford, Manchester.
1883. Cunningham, Alex., Assistant Forester, Lilleshall, Newport, Salop.
1881. Cunninghame, J. C., of Craigends, Johnstone, Renfrewshire.
1868. Cunningham, John, Forester, Ardross, Alness, Ross-shire.
1880. Curr, James, Kindar Lodge, Dumfries.
1885. Curtis, Charles, Assistant Superintendent of Forests, Penang.

1884. Dalziel, James, Forester, Culzean Castle, Maybole, Ayrshire.
1869. Daniels, Peter, Forester, Slindon Hall, Arundel, Sussex.
1884. Davidson, Alex., Assistant Forester, Durris, Aberdeen.
1874. Davidson, George, Land Steward, Carriden, Linlithgow.
1883. *Davidson, James, Assistant Forester, Cavers, Hawick.*
1865. Davidson, John, Land Agent, Greenwich Hospital Estates, Haydon Bridge, Northumberland.
1857. Davidson, John, Forester, Aldbar, Brechin.
1884. Deane-Drake, Joseph Edward, Stokestown House, New Ross, Ireland.
1883. Denne, John, Jun., Greenstreet, Sittingbourne, Kent.
1877. Dewar, John, Assistant Forester, Altyre, Forres.
1882. Dick, Archd., Assistant Forester, Hopetoun, South Queensferry.
1883. Dickie, James, Gardener, Curraghmore, Portlaw, Waterford.
1884. Dickson, A., Steward, Baron's Court, Tyrone, Ireland.
1870. Dickson & Sons, James, Newton Nurseries, Chester.
1858. Dickson & Sons, James, Nurserymen and Seedsmen, 32 Hanover Street, Edinburgh.
1854. Dickson & Turnbull, Nurserymen and Seedsmen, Perth.
1868. Dodds, George, Overseer, Wyreside Cottage, Lancaster.
1877. Doig, Charles, Overseer, Glen Tulchan, Methven, Perth.
1880. *Doragh, Andrew, Foreman, The Gardens, Knockmaroon Lodge, Chapelizod, Dublin.*

Date of Election.

1882. Douglas, Captain Palmer, of Cavers, Hawick.
1884. Doughty, Wm., Forester, Langholm Estate, Canonbie, Dumfriesshire.
1867. Dow, Thomas, Overseer, Idvies, Forfar.
1862. Drummond & Sons, William, Nurserymen, Stirling.
1866. Duff, James, Factor, Blackwood, Lesmahagow.
1868. Duff, James, Freeland, Forgandenny, Perthshire.
1868. Duff, James, Wood Manager, Bells Yew Green, Tunbridge Wells, Kent.
1884. Dunphy, Edward, Timber Merchant, Inistiogue, Kilkenny.
1875. Duncan, James, Land Steward, Glack, Old Meldrum.
1862. Duncan, William, Forester, Ardgowan, Greenock.
1885. Dunn, David, Superintendent, Queen's Park, Heywood, Manchester.
1867. Dunn, Malcolm, The Palace Gardens, Dalkeith.
1873. Durward, Robert, Manager, Blelack, Dinnet, Aberdeenshire.

1885. Eddington, Francis, Forester, Windlestone, Ferryhill, County Durham.
1884. Eden, Henley, Agent to His Grace the Duke of Somerset, Bradley Estate Office, Maiden Bradley, Bath.
1882. Elder, Wm., Forester, 40 Susannah Street, Alexandria, Dumbartonshire.
1878. Elliot, Sir Walter, K.C.S.I., F.R.S., Wolfelee, Hawick.
1877. Erskine, William, of Oaklands, Trinity.
1881. Ewart, Andrew, Gardener, Moniack, Beauly.
1873. Ewing, David, Forester, Strichen House, Aberdeen.

1884. Farquharson, George, Assistant Forester, Durris, Aberdeen.
1869. Ferguson, Alex., 21 Duddingston Park, Portobello.
1880. Fergusson, Sir James Ranken, Bart., Spitalhaugh, West Linton.
1884. Ferguson, Wm. Hooker, Knowefield Nurseries, Carlisle.
1872. Fingland, John, Forester, Drumlanrig, Thornhill, Dumfriesshire.
1879. Finlay, Thos., Assistant Forester, Hopetoun House, South Queensferry.
1883. Finlayson, Robert, Assistant Forester, Hopetoun, South Queensferry.
1869. Fisher, William, Estate Agent, Wentworth Castle, Barnsley, Yorkshire.
1876. Fiskin, Alexander, Assistant Forester, Rossdhu, Dumbartonshire.
1884. Fleming, John, Camperdown Saw-Mills, Dundee.
1864. Forbes, Andrew, Forester, Stracathro, Brechin.
1884. Forbes, Alex. J., Marybank School, Muir of Ord.
1882. Forbes, David, Assistant Forester, Salton Hall, Pencaitland.
1884. Forbes, John, Buccleuch Nurseries, Hawick.
1878. Forbes, Robert, Overseer, Clova, Lumsden, Aberdeenshire.
1873. *Forbes, William, Stoneleigh Estate Office, Kenilworth, Warwickshire.*
1869. Forgan, James, Gardener and Overseer, Bonskeid, Pitlochrie.
1884. Forrest, Thomas, Assistant Forester, Allanton House, Newmains.
1883. Forrest, Sir William J., Bart. of Comiston, Edinburgh.
1883. Forrester, John, Architect, 37 Broughton Place, Edinburgh.
1878. Forsythe, John M., Wood Manager, Park Farm Office, Woburn, Bedfordshire.
1880. Fotheringham, Alex., Manager, Newholme, Dolphinton.
1884. Foulis, Thomas, Publisher, 9 South Castle Street, Edinburgh.
1882. *Fowler, Alex., Assistant Forester, Blackwood, Lesmahagow.*
1882. *Fraser, Arch., Assistant Forester, Benmore Estate, Kilmun, Greenock.*

Date of Election.

1876. Fraser, Donald, Forester, Poole, South Milford, Yorkshire.
1883. Fraser, Frank, Gardener, Tillery, Aberdeen.
1866. Fraser, Hugh, Leith Walk Nurseries, Edinburgh.
1874. Fraser, James, Forester, Cobairdy, Huntly.
1878. *Fraser, L. A. S., Assistant Forester, Athy, Ireland.*
1857. Fraser, P. Neill, of Rockville, Murrayfield, Edinburgh.
1868. Fraser, Simon, Forester, Haddo House, Aberdeenshire.
1883. Fraser, Sweton, Assistant Forester, Eilanreoch, Glenelg, Lochalsh.
1882. *French, Edward, Assistant Forester, Scone, Perth.*
1884. Frost, Francis, Forester, Kilgraston, Bridge of Earn, Perthshire.
1869. Frost, Philip, Gardener, Dropmore, Maidenhead.

1878. Galletly, James, Overseer, Bonhard, Perth.
1874. Galloway, George, Estate Offices, Woodhouses, Whitchurch, Salop.
1854. Gardiner, Robert, Agent, Birchgrove, Crosswood, Aberystwith.
1885. Gibb, James, Assistant Forester, Kinnaird Castle, Brechin.
1870. Gilbert, James, Forester, Gallovie, Kingussie.
1880. Gilchrist, Dugald, of Ospisdale, Sutherland.
1881. Gilchrist, William, Forester, 35 Moray Street, Elgin.
1876. Gillanders, Alex. T., Forester, High Legh Hall, Knutsford, Cheshire.
1876. Glassbrook, Geo., Bailiff, Remenham Farm, Henley-on-Thames, Bucks.
1880. Glen, David A., Assistant Forester, Gartshore, Kirkintilloch.
1879. Gloag, W. E., of Kincairny, Advocate, 6 Heriot Row, Edinburgh.
1869. *Gordon, James, Forester,* 17 *Avondale Place, Edinburgh.*
1884. Gordon, James W., Assistant Forester, Balmoral, Ballater.
1881. Gorrie, Thomas, Assistant Forester, Logiealmond, Perth.
1880. Gough, William C., Assistant Forester, Wykeham, York.
1869. Gow, James, Forester, Logie Cottage, Airthrey, Stirling.
1875. Gow, Peter, Overseer, Laggan, Ballantrae, Ayrshire.
1882. Gow, Robt., Assistant Forester, Raith, Kirkcaldy, Fifeshire.
1878. *Gow, Thomas, Assistant Forester, Scone, Perth.*
1884. Gow, William, Assistant Forester, Pitfour, Aberdeenshire.
1870. *Grandison, James, Errol Park, Errol.*
1882. Grant, Alex. M'D., Assistant Forester, Hopetoun, South Queensferry.
1873. Grant, Colonel James A., C.B., C.S.I., 19 Upper Grosvenor Street, London, W.
1867. Grant, Donald, Forester, Drumin, Ballindalloch.
1876. Grant, David, Forester, Dalvey, Forres.
1873. Grant, James, Forester, Heath, Chesterfield.
1873. Grant, James, Assistant Forester, Abernethy, Strathspey.
1878. Grant, James, Assistant Forester, Drumpellier, Coatbridge.
1883. Grant, John, Assistant Forester, Balmoral, Ballater.
1875. Grant, John C., Forester, Portsoy, Banffshire.
1882. *Gray, James, Assistant Forester, Kelly, Wemyss Bay.*
1879. *Gray, Robert,* 15 *New Road, Newton-on-Ayr.*
1872. Green, Alex., Forester, Allanton House, Newmains, Lanarkshire.
1883. Green, Arthur A., 58 Broughton Street, Edinburgh.
1872. Greive, James, Messrs Dicksons & Co.'s Nurseries, Pilrig, Edinburgh.
1882. Grieve, Walter, Forester, Drygrange, Melrose.
1881. *Grigor, John, Assistant Forester, Rosehaugh, Killen, Ross-shire.*

Date of Election.

1879. Haddington, the Right Hon. the Earl of, Tyninghame, Prestonkirk.
1880. Haddon, Walter, Solicitor, Royal Bank, Hawick.
1881. Hadfield, Gordon, Forest Department, Madras.
1882. Hamilton, Donald C., Assistant Forester, Warkton, Kettering, Northamptonshire.
1873. Hamilton, John B. Baillie, of Arnprior, Cambusmore, Callander.
1880. Hamilton, Robert, Trinity Lodge, Trinity, Edinburgh.
1866. Hardie, Walter, Midburn, Elstree, Herts.
1880. Harlond, Henry, Forester, Arlington, Barnstaple, North Devon.
1873. Harrower, William, Forester and Ground Officer, Garth, Aberfeldy.
1872. Hartland, Richard, The Lough Nurseries, Cork.
1882. Hattrick, James, Forester, Johnstone Castle, Renfrewshire.
1882. Haughs, David, Assistant Forester, 3 Wellington Place, Musselburgh.
1878. *Haugh, James, Assistant Forester, Colenden, Stormontfield, Perth.*
1860. Havelock, Thomas, Forester, Raby Park, Staindrop, Darlington.
1880. Havelock, W. B., Forester, Duncombe Park, Helmsley, York.
1882. Hay, Alex., 96 Constitution Street, Leith.
1869. Hayman, John, Overseer, Dumfries House, Cumnock.
1866. Henderson, Arch., Forester, Clonad Cottage, Tullamore, King's County.
1877. Henderson, George, Assistant Forester, Cavers Estate, Hawick.
1871. Henderson, John, Overseer, Vogrie, Ford, Dalkeith.
1883. Henderson, W., The Gardens, Balbirnie, Markinch.
1878. Henry, Kennedy, Forester, Hallyburton, Coupar-Angus.
1871. Hetherton, Walter, Forester, Merton, Beaford, Devon.
1882. Hodgart, James, Assistant Forester, Johnstone Castle, Renfrewshire.
1886. Hodson, Richard Edmund, Hollybrooke, Bray, Co. Wicklow, Ireland.
1866. Hogarth, James, Forester, Culhorn, Stranraer.
1884. Hogg, Andrew, Assistant Forester, Jardine Hall, Lockerbie.
1866. *Hogg, Thomas, Forester, Beau-Desert, Rugeley, Staffs.*
1874. Home, Edward, Assistant Forester, Edington, Chirnside.
1872. Home, George, Assistant Forester, Bellstane, Drumlanrig, Thornhill.
1883. Homewood, Chas. E., Ufton Court, Sittingbourne, Kent.
1882. Hood, James, Assistant Forester, Freeland, Forgandenny, Perth.
1880. Hopetoun, The Right Hon. the Earl of, Hopetoun House, South Queensferry.
1882. Hoskins, Edward, Assistant Forester, Kinmel Park, Abergele, Wales.
1868. Howden & Co., The Nurseries, Inverness.
1876. Hull, Frank, Forester, Lilleshall, Newport, Salop.
1880. Hume, William, Iron and Wire Fence Manufacturer, 217 Buchanan Street, Glasgow.
1878. Hunter, James, Assistant Forester, Dalmeny Park, Edinburgh.
1880. Hunter, John, Forester, Duncrub Park, Dunning, Perthshire.
1884. Hunter, Wm., Forester, Drummond Castle, Muthill, Perthshire.
1873. Hussey, Samuel M., Estate Office, Tralee.
1881. Hutton, James, Forester, Glenormiston, Innerleithen, Peebles.

1880. Imrie, James, Forester and Land Steward, Rossie Castle, Montrose.
1884. Inch & Riddell, Seedsmen, Victoria Street, Edinburgh.
1882. Innes, Alex., Assistant Forester, Dingley, Market Harboro'.

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1884. Innes, Richard S., Upholsterer, 77 South Bridge, Edinburgh.
1870. Ireland & Thomson, Nurserymen and Seedsmen, Waterloo Place, Edinburgh.
1886. Irvine, Daniel, Overseer, Fincastle, Pitlochrie.

1875. Jackson, Magnus, *Photographer to the Society*, Princes Street, Perth.
1880. Jackson, Thomas, Princes Street, Perth.
1884. Jameson, Martin, Fernhill, Perth.
1869. Jeffrey, James, Forester, Craighall, Blairgowrie.
1874. Johnston, George, The Gardens, Glamis Castle, Forfarshire.
1883. Johnston, Robert, Forester, Somerley, Ringwood, Hants.
1870. Johnston, William, Forester, The Lee, Lanark.
1878. Johnstone, Adam, Forester, Coollattin, Shillelagh, County Wicklow, Ireland.
1882. Johnstone, Wm., Forester, Munches, Dalbeattie.
1868. Johnstone, W. W., Manager, Messrs F. & A. Dickson's Nurseries, Chester.

1867. Kay, James, Wood Manager, Bute Estate, Rothesay.
1880. Keay, Robert B., Forester, Redcastle, Inverness.
1865. Kedzie, Walter, Forester, Arundel, Sussex.
1878. *Keillor, John*, 18 *Clapperton Place, Sunnybank, Edinburgh.*
1870. Keir, David, Forester, Blair Athole, Perthshire.
1876. Kelman, John, Forester, Glenkindie, Aberdeen.
1882. Kennedy, John, Forester, Flakebridge, Appleby, Westmoreland.
1873. *Kennedy, John, Forester, Pitkerrald, Glen Urquhart, Drumnadrochit.*
1882. Kennedy, Walter, Forester, Skelbo, Dornoch.
1872. Kennedy, William, Overseer, Glen Carradale, Greenock.
1880. *Kerr, Wm. F., Assistant Forester, Blackwood, Lesmahagow.*
1870. Kidd, James B., Forester, The Poles, Dornoch.
1881. Kidd, William, Assistant Forester, Altyre, Forres.
1880. King, George, Forester, Dochfour, Inverness.
1866. Kinghorn, Adam, Forester, Rochsoles, Airdrie.
1883. Kinnear, Alex., Forester, Galloway House, Garlieston.
1878. Knight, Henry, Royal Gardens, Laeken, Brussels, Belgium.
1884. Knox, Henry, Forester, Brae Lodge, Maybole, Ayrshire.
1884. Kyrke, Arthur Venables, Chard, Somersetshire.
1884. Kyrke, Richard Henry Venables, of Nantyffrith, Wrexham, North Wales.
1876. Kyrke, R. V., of Penywern, Mold.

1886. Laidlaw, William, Forester, Newbattle, Dalkeith.
1885. Laird, James W., Nurseryman, 73 Nethergate, Dundee.
1865. Laird, R. B., & Sons, Nurserymen and Seedsmen, 17*a* Frederick Street, Edinburgh.
1881. Laird, William, Forester, Durris, Aberdeen.
1858. Lamont, John, sen., The Glen Nurseries, Musselburgh.
1873. Lauriston, Alexander, Woodman, Gorse Farm, Rufford, Ollerton, Notts.
1881. Lawrie, Robert, Manager, Glencasley, Invershin, Sutherland.

Date of Election.

1880. *Lees, John, Wood Manager, Archerfield, Drem.*
1878. *Lees, John, Manager, Rossmore Park, Monaghan, Ireland.*
1877. Lees, William, Assistant Forester, Ardgowan, Greenock.
1870. Leggat, Alexander, Forester, Vale Royal, Northwich, Cheshire.
1874. Leigh, William, of Woodchester Park, Stonehouse, Gloucestershire.
1880. Leishman, John, Forester, Cavers Estate, Hawick.
1880. *Lindsay, Alexander, Manager, Eythrope, Aylesbury, Bucks.*
1879. Lindsay, Robert, Curator, Royal Botanic Garden, Edinburgh.
1884. *Lindsay, Wm., Assistant Forester, Jardine Hall, Lockerbie.*
1883. Little, William, Côte, St Antoine, Montreal, Canada.
1883. Loch, Sir Henry B., K.C.B., Governor of Victoria, Australia.
1881. Low, Joseph, Forester, Bickenhall, Taunton, Somersetshire.

1881. Macaulay, James F., Forester, Castle Leod, Strathpeffer.
1876. *M'Bain, William, Forester, Clandeboye, County Down.*
1876. Macbean, John, Forester, Kinlochmoidart, Ardgour.
1872. M'Coll, James M., Factor, Craignish Castle, Lochgilphead, Argyleshire.
1882. M'Conochie, Daniel, Forester, Houston, Johnstone.
1870. M'Corquodale, D. A., Bank of Scotland, Carnoustie.
1855. M'Corquodale, Donald, Forester, Dunrobin Castle, Golspie.
1882. *M'Creath, Walter, Assistant Forester, Kelly, Wemyss Bay.*
1869. M'Cutcheon, Robert, Forester, Whittinghame, Prestonkirk.
1870. Macdonald, Alexander, Forester, Balnagowan, Parkhill, Ross-shire.
1878. Macdonald, Allan, Commissioner of Mackintosh Estates, 16 Union Street, Inverness.
1878. Macdonald, Duncan, Manager, Mulroy, Carrigart, Letterkenny, Ireland.
1877. *M'Donald, James, Assistant Forester, Lynedoch, Perth.*
1881. M'Donald, Peter, Assistant Forester, Bridgend, Islay.
1878. *M'Donald, Peter, Assistant Forester, Eglinton Castle, Irvine.*
1879. M'Dougall, Alex., Forester, Drumbuie Lodge, Dunkeld.
1886. M'Dowall, Thomas, Assistant Forester, Ardgowan, Greenock.
1882. M'Farlane, John, Forester, Tarbet, Loch Lomond.
1886. M'Farlane, Walter, Assistant Gardener, Morton Hall, Edinburgh.
1881. M'Gilp, John, Assistant Forester, Ardgowan, Greenock.
1882. M'Glashan, David, Assistant Forester, Murthly Castle, Perthshire.
1871. M'Grath, Patrick, Forester, Galtee Castle, Mitchelstown, Tipperary.
1886. MacGregor, Alex., Assistant Forester, Cross Roads, Aylesbury.
1876. *MacGregor, Alex., Forester, Lewis Castle, Stornoway.*
1881. M'Gregor, Duncan, Assistant Forester, Abernethy, Strathspey.
1878. M'Gregor, Duncan, Forester, Camperdown, Dundee.
1882. MacGregor, James G., Assistant Forester, Cally Mains, Gatehouse.
1876. M'Gregor, Robert C., Forester, Tehidy Park, Camborne, Cornwall.
1880. M'Intosh, Angus, Forester, Brocklesby Park, Ulceby, Lincolnshire.
1875. *M'Intosh, Richard, Assistant Forester, Salton Hall, Pencaitland.*
1885. MacIntosh, William, 5 Thistle Street, Edinburgh.
1883. M'Intyre, Alex., Assistant Forester, Craigengillan, Dalmellington, Ayrshire.
1882. M'Intyre, John, Wood Merchant, Cardross, Dumbartonshire.
1881. Mackay, H., Timber Merchant, Shandwick, Nigg, Ross-shire.

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1884. M'Kay, James, Forester, Breadalbane Estates, Killin.
1875. Mackay, John, Lauderdale Estate Office, Wyndhead, Lauder.
1867. Mackenzie, Alex., Warriston Nursery, Inverleith Row, Edinburgh.
1882. Mackenzie, Sir Alex. Muir, Bart. of Delvine, Dunkeld.
1881. M'Kenzie, Donald, Forester, Ballinakill, Clachan, Argyleshire.
1880. *M'Kenzie, James, Assistant Forester, Sauchie, Stirling.*
1883. M'Kenzie, James, Assistant Forester, Abernethy, Strathspey.
1867. Mackenzie, John Ord, of Dolphinton, W.S., 9 Hill Street, Edinburgh—*Auditor.*
1880. Mackenzie, Major, of Findon, Mount Gerald, Dingwall.
1882. Mackie, James H. J., Land Steward, Invermay, Dunning, Perthshire.
1880. M'Killop, Alexander, Forester, Castle Menzies, Aberfeldy.
1877. M'Kinnon, Alexander, The Gardens, Scone Palace, Perth.
1883. M'Kinnon, George, The Gardens, Melville Castle, Lasswade.
1877. M'Kinnon, John, The Gardens, Kylemore Castle, County Galway.
1878. Mackintosh, The, of Mackintosh, Moy Hall, Inverness.
1870. M'Laggan, John G., Forester, The Cairnies, Glenalmond, Perthshire.
1879. M'Laren, Charles, Land Steward, Cally Lodge, Dunkeld.
1868. M'Laren, John, Ballincrieff, Drem.
1854. M'Laren, John, Inspector and Valuer of Woods, Hawthornvale Winchburgh.
1878. M'Laren, John T., Overseer, Kennet, Alloa.
1867. M'Lean, Andrew, Forester, Rutherford, Roxburgh.
1876. *M'Lean, John, Forester, 2 Alfred Place, Canonmills.*
1872. M'Lean, Malcolm, The Gardens, Vinters Park, Maidstone, Kent.
1866. M'Lean, William, Forester, Eglinton Castle, Irvine.
1883. Macleish, James, Hydraulic Engineer, Perth.
1865. M'Lellan, Duncan, Superintendent of Parks, 7 Kelvingrove Terrace, Glasgow.
1882. M'Lellan, Robt., 5 Dowan Vale Terrace, Partick.
1874. M'Leod, Angus A., Superintendent of City Gardens, 14 Royal Exchange, Edinburgh.
1884. *M'Lure, George, The Gardens, Trinity Grove, Edinburgh.*
1885. M'Nicoll, Douglas, Estate Office, Mostyn, Holywell.
1881. Macrae, John, Forester, Higham, Bury St Edmonds.
1884. Main, Adam, Assistant Forester, Cluny Castle, Aberdeen.
1880. Marr, George, The Gardens, Hatton Castle, Turriff, Aberdeenshire.
1873. *Marshall, Robert, Forester, Invercauld, Braemar, Aberdeenshire.*
1871. Marshall, Robert, Bailiff, Kirklington Hall, Southwell, Notts.
1876. Martin, James, Forester, Stareton, Kenilworth, Warwickshire.
1884. Massie, William H., Dicksons & Co., 1 Waterloo Place, Edinburgh.
1885. Maxtone, John, Forester, Roseneath, Argyleshire.
Maxtone, Robert, Forester, Castle Strathallan, Auchterarder.
1886. Maxwell, Sir Herbert Eustace, Bart., of Monreith, M.P., Wigtownshire.
1886. Maxwell, Captain A. C., of Terregles, Dumfries.
1879. Meikle, R. A., Agent for Lord Alington, Moor Crichel, Dorsetshire.
1873. Menzies, George, Agent, Trentham, Stoke-on-Trent.
1880. Menzies, Wm., Forester, Dissington, Newcastle.

Date of Election.

1854. Methven, Thomas, & Sons, Nurserymen and Seedsmen, Leith Walk Nurseries, Edinburgh.
1865. Michie, Christopher Young, Forester, Cullen House, Banffshire.
1864. Michie, James, Forester, Wemyss Castle, East Wemyss, Fife.
1871. Middlemass, Archibald, Forester, Meikleour, Perthshire.
1880. *Miller, James W., Manager, Skibo Castle, Dornoch.*
1886. Miller, John J. W., Agent for the Marquis of Salisbury, Hatfield, Herts.
1885. Milne, William, Forester, Urie House, Stonehaven.
1883. Milroy, Alex., Forester, Glencorse, Edinburgh.
1868. Mitchell, David, 6 Comely Bank, Edinburgh.
1884. Mitchell, David, Assistant Forester, Durris, Aberdeen.
1880. Mitchell, James, Forester, Fryston Hall, Ferry Bridge, Yorkshire.
1880. Mitchell, James, Assistant Forester, Airth Castle, Larbert.
1869. Mitchell, James, Aldie Castle, Kinross.
1876. Mitchell, James, Forester, Donibristle, Aberdour, Fife.
1886. Mitchell, James, Assistant Forester, Durris Estate, Aberdeen.
1876. Mitchell, John, Forester, Bolton Abbey, Skipton, Yorks.
1876. More, Robert, Forester, Hafton, Kirn, Argyleshire.
1876. Morgan, George, Wood Merchant, Turret Bank, Crieff.
1875. Morgan, Hugh, Wood Merchant, Crieff.
1877. Morrison, Alexander, Nurseryman, Elgin.
1877. Morrison, James, The Gardens, Archerfield, Drem.
1862. Morrison, John, Coney Park Nursery, Stirling.
1884. Morshead, Frank Upton Anderson, Salcombe Regis, Sidmouth, Devonshire.
1866. Muirhead, John, Forester, Bicton, Budleigh Salterton, Devonshire.
1876. Munro, Hugh, Forester, Holkham Hall, Norfolk.
1871. Munro, James, Assistant Forester, Darnaway Castle, Forres.
1883. Murdoch, James Barclay, Barclay, Langside, Glasgow.
1883. Murray, John, Assistant Forester, Murthly Castle, Perthshire.
1878. Murray, Robert R., Forester, Adare Manor, Co. Limerick.
1871. Myles, James, Forester, Kinnaird Castle, Brechin.

1882. Napier, Wm., Forester, Ballykelly, Londonderry.
1885. Newbigging, John W., Nurseryman, Dumfries.
1879. Newton, Robert P., of Castlandhill, Polmont Bank, Polmont.
1870. Nicol, William, Forester, Cluny Castle, Aberdeen.
1869. Nicol, W. R., Forester, Loudoun Castle, Galston.

1878. Ogilvie, David, Forester, The Guynd, Arbroath.
1882. Oliver, George, Assistant Forester, Snettisham, Kings Lynn.
1868. Ormiston & Renwick, Nurserymen and Seedsmen, Melrose.

1875. Page, Andrew Duncan, Land Steward, Culzean, Maybole.
1857. Palmer & Son, John, Nurserymen, Annan.
1886. Park, Alexander, Factor, Gartshore, Kirkintilloch.
1857. Parker, James, Forester, Belvoir Castle, Grantham.
1856. Paterson, Andrew, Agent, Paultons, Romsey, Hampshire.

Date of Election.

1885. Paterson, A. T., Steward, New Hall, Salisbury.
1879. Paton, Hugh, Nurseryman, Kilmarnock.
1876. *Patton, Donald, 1 Livingstone Place, Edinburgh.*
1870. Pearson, Joshua, Spirit Merchant, 14 Pitt Street, Glasgow.
1869. Peebles, Andrew, Estate Office, Albury, Guildford.
1871. Pendreigh, John, Assistant Forester, Port Bannatyne, Rothesay.
1872. Philip, John, Wood Merchant, Bonnyrigg, Lasswade.
1882. Philip, Robt., Assistant Forester, Longleat, Horningsham, Wilts.
1878. Philips, Alexander, Land Steward, Logiealmond, Perth.
1882. Phillips, Alex., Assistant Forester, Balquhatson, Stamannan.
1878. Pitcaithley, Alexander, Forester, Glentruim, Kingussie.
1874. Platt, Colonel Henry, Gorddinag, Langairfechan, near Bangor.
1877. Ponsonby, Charles John, Deputy-Conservator of Forests, Indian Forest Department, Baraitch, Oudh (12 Royal Circus, Edinburgh).
1872. *Powner, Thomas, Forester, Witley Court, Stourport, Worcestershire.*
1869. Pressly, David, Glenmaroon House, Chapelizod, Dublin.
1883. Preston, Wm. M., Vaynol Park, Bangor, Wales.
1881. *Proctor, John, Assistant Forester, Kelly, Wemyss Bay.*
1879. Pryke, Walter, 1 Great Stanhope Street, Mayfair, London, W.
1878. Purdie, Robert, Forester, Castle Blaney, County Monaghan, Ireland.
1875. Purves, Alexander Paterson, W.S., 12 Queen Street, Edinburgh.

1876. Rae, James S., Forester, Dunipace House, Larbert.
1876. Rae, William Alexander, 52 St Swithin Street, Aberdeen.
1884. Rae, Wm., Forester, Kippenross, Dunblane.
1886. Ramage, J. L., Assistant Forester, Armsheugh, Grougar, Galston.
1870. Rattray, Thos., Forester, Westonbirt House, Tetbury, Gloucestershire.
1854. Ravenscroft, Edward, 14 London Road, St John's Wood, London, N.W.
1876. *Ray, Andrew, Assistant Forester, Athronhall, Milnathort.*
1872. Reid, James S., Overseer, Kerse Estate, Falkirk.
1881. Reid, James, The Nurseries, Elgin.
1881. Riach, John, Assistant Forester, Rosehaugh, Avoch, Ross-shire.
1873. Richardson, Adam, Royal Botanic Garden, Edinburgh.
1880. *Riddall, David, Assistant Forester, Kintore.*
1877. Rider, William H., 14 Bartholomew Close, London, E.C.
1876. Ritchie, Alexander, Assistant Forester, Logiealmond, Perth.
1880. Ritchie, Wm., Assistant Forester, Lynedoch, Perth.
1882. *Robertson, Alex., Assistant Forester, Eglinton Castle, Irvine.*
1884. Robertson, Alex., Assistant Forester, Dupplin Castle, Perth.
1879. Robertson, Charles, Assistant Forester, Old Blair, Blair Athole.
1880. Robertson, David M., Nurseryman, Trinity, Edinburgh.
1879. Robertson, Donald, Forester, Novar, Evanton, Ross-shire.
1871. Robertson, George, Overseer, Plean, Bannockburn.
1874. Robertson, George, jun., Bailiff, Gilling Castle, York.
1882. Robertson, James, Assistant Forester, Baldornoch, Blairgowrie.
1881. Robertson, John, Forester, Achnadrish, Tobermory.
1871. Robertson, John, Forester, Minto House, Hawick.
1883. Robertson, William, Assistant Forester, Murthly Castle, Perthshire.
1883. Robertson, W. H., Forester, Loughcrew, Oldcastle, Co. Meath.

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1883. Robertson, Wm. M., Gardener, Rossdhu, Luss, Dumbartonshire.
1869. Robertson, William W., Forester, Blinkbonny, Earlston.
1857. Robson, Alexander, Forester, Dochfour Woods, Lochend, Inverness.
1880. *Rodemer, Charles, Assistant Forester, Murthly Castle, Perthshire.*
1874. Ross, Arch., Overseer, Skipton Castle, Skipton-in-Craven, Yorkshire.
1880. Ross, James, Solicitor and Factor, Inverness.
1881. Ross, John, Assistant Forester, Balnagowan Castle, Ross-shire.
1882. *Ross, Lawson, Assistant Forester, Cavers, Hawick.*
1884. Ruddiman, Walter, Assistant Forester, Rothes Estate, Leslie, Fife.
1874. Rule, John, Forester, Monymusk, Aberdeenshire.
1867. Russell, John, Manager, Craigie House, Ayr.
1884. Russell, Thos., The Gardens, Keir House, Bridge of Allan.
1872. Rust, Joseph, The Gardens, Eridge Castle, Tunbridge Wells, Kent.
1865. Rutherford, Andrew, Agent, Shimblely Hall, Northallerton.
1870. Rutherford, John, Forester, Linthaugh, Jedburgh.

1858. Sandbach, Henry R., Hafodunos, Abergele.
1875. Sang, Edmund, Nurseryman and Seed Merchant, Kirkcaldy.
1879. Scaling, William, Willow Nurseryman, Basford, Notts.
1871. Scarth, T. W., Land Agent, Raby Castle, Staindrop, Darlington.
1870. Scott, Adam, Forester, Southwick Park, Fareham, Hants.
1881. Scott, Andrew, Assistant Forester, Foulis-Wester, Crieff.
1883. Scott, Andrew, Schoolmaster, Forgan, Newport, Fife.
1867. Scott, Daniel, Wood Manager, Darnaway Castle, Forres.
1883. Scott, David P., 9 Renny Place, Broughty Ferry.
1881. Scott, James, Forester, Woollerton, Notts.
1879. Scott, John, Forester, Curraghmore, Portlaw, Ireland.
1880. Scott, John T., Estate Office, Winstanley, Wigan.
1880. *Scott, Walter, Overseer, Cartland, Lanark.*
1867. Scott, Walter, Forester, Oxnam, Jedburgh.
1883. Scott, William, Assistant Forester, Devonshaw, Dollar.
1870. Shanks, John, Forester, Kildrummy Castle, Mossat, Aberdeenshire.
1881. Sherrit, James, Jun., Assistant Forester, Idvies, Forfar.
1877. *Shields, Robert, Assistant Forester, Keith Hall, Aberdeenshire.*
1881. *Shuan, John, Assistant Forester, Killen, Ross-shire.*
1880. Sibbald, Thomas, Assistant Forester, Cavers Estate, Hawick.
1870. Sim, William, Nurseryman, Forres.
1874. Sime, John, Timber Merchant, Rafford, Forres.
1869. *Simpson, Peter, Forester, Limefield House, West Calder.*
1882. Sinclair, Peter, Wood Merchant, Perth.
1869. Sinton, James, Forester, Stourhead Estate, Stourton, Bath.
1872. Skeldon, John, Assistant Forester, Duns Castle, Duns.
1886. Slater, Alexander, Assistant Forester, Lynedoch, Perth.
1868. Slater, Andrew, Overseer, Haystoun, Peebles.
1869. Smith, Andrew, Factor, Castlemains, Douglas, Lanarkshire.
1880. Smith, David, Forester, Woodend, Rosslyn.
1886. Smith, George, Assistant Forester, Durris Estate, Aberdeen.
1873. Smith, G. B., Wire Fence Manufacturer, 61 West Regent St., Glasgow.
1883. *Smith, Henry, Assistant Forester, Kailzie Estate, Peeblesshire.*

Date of Election.

1871. Smith, James, The Gardens, Mentmore, Leighton-Buzzard, Bucks.
1883. Smith, James, The Gardens, Hopetoun, South Queensferry.
1875. *Smith, John, care of R. Smith & Co., St John's Nurseries, Worcester.*
1870. Smith, John Crombie, Forester, Portmore, Eddleston, Peebles.
1886. Smith, John, Surveyor, Romsey, Hampshire.
1884. Smith, John Edward, Timber Buyer, 219 Rushton Road, Thornbury, near Bradford.
1870. Smith, Thomas, Nurseryman and Seedsman, Stranraer.
1869. *Smith, W. Baxter, 3 Broadlands, South Norwood, London.*
1883. Smith, William, Chemist, Stockbridge, Edinburgh.
1883. Smith, W., & Son, Patentees of the Celyddon Wire Fence, Inverness.
1878. Sothern, Peter, Forester, Broomhall, Dunfermline.
1884. Spiers, David, Overseer, Mugdrum, Newburgh, Fife.
1884. Sprot, Colonel John, of Riddell, Lilliesleaf, Roxburghshire.
1882. Stalker, Donald, Forester, Murthly Castle, Perthshire.
1864. Stapylton, Major, Myton Hall, Boroughbridge, Yorkshire.
1874. Stark, John, Forester, Springkell, Ecclefechan, Dumfries.
1873. Stephen, John, Forester, Abernethy, Strathspey.
1880. *Stephens, Wm., Assistant Forester, Scone, Perth.*
1868. Stewart, Alexander, Agent, Bodnaut Estate, Conway, N. Wales.
1870. Stewart, John, Overseer, Abington, Lanarkshire.
1882. Stewart, John, Forester, Inveraray Castle, Argyleshire.
1875. Stewart, J. M., Cherry Tree Cottage, Nusworth, Whitefield, near Manchester.
1876. Stewart, Robert, Forester, Stonefield, Tarbert, Lochfyne, N.B.
1864. Stewart, William, Land Steward, Dalhousie Castle, Lasswade.
1876. Stirling, John, Forester, Cally Mains, Gatehouse of Fleet.
1876. Stuart, Charles, Forester, Glenmoriston, Inverness.
. *Stuart, John, Assistant Forester, Kinniel, Bo'ness, Linlithgowshire.*
1878. Stuart, John, Wood Manager, Castle Grant, Grantown, Strathspey.
1868. *Stuart, Lewis A. G., Durris Estate, Aberdeenshire.*
1867. Stuart & Mein, Nurserymen, Kelso.
1876. Sturrock, David, Assistant Forester, Panmure, Carnoustie.
1878. Sturrock, William, Assistant Forester, The Nurseries, Ayr.
1883. Sturt, W. Neville, Union Club, London.
1883. Swan, James, Assistant Forester, Cavers, Hawick.
1872. Swan, R. G., Auctioneer, Duns.
1873. Swinton, A. Campbell, LL.D., F.R.S.E., of Kimmerghame, Duns.
1884. Syme, David, Manager, Peter Lawson & Son, Limited, Edinburgh.
1869. Symon, John, Forester, Cawdor Castle, Nairn.
1870. Symon, Peter, Town's Forester, Forres.

1869. Tait, David, Forester, Owston Park, Doncaster, Yorkshire.
1871. Taylor, David, Overseer, Barskimming, Mauchline.
1882. Taylor, William, Assistant Forester, Dupplin Castle, Perthshire.
1883. Thomson, Alex., Assistant Forester, Murthly Castle, Perthshire.
1884. Thomson, B. Lumsden, 85 Gracechurch Street, London.
1884. Thomson, Charles, Assistant Forester, Jardine Hall, Lockerbie.
1879. Thomson, George B., Forester, Blenheim Park, Woodstock, Oxfordshire.

Date of Election.

1869. THOMSON, Lockhart, S.S.C., 114 George Street, Edinburgh.
1871. TOMLINSON, Wilson, Forester, Clumber Park, Worksop, Notts.
1881. TULLOCH, Donald, Assistant Forester, Abernethy, Strathspey.
1882. TURNBULL, John, Overseer, Brayton Hall, Carlisle.

1882. ULYATT, Thomas, Assistant Forester, Rufford, Ollerton, Newark, Notts.
1883. UNDERWOOD, Henry E., Sub-Agent, Fornham, St Genevieve, Bury St Edmunds, Suffolk.

1878. VEITCH, Charles, Assistant Forester, Portmore, Eddleston, Peebles.
1882. VEITCH, James B., Kakiacherra, Balisera Tea Estate, Matigunj, Sylhet, India.

1873. WALKER, George, Forester, Balgonie, Markinch, Fife.
1879. WALKER, John, Assistant Forester, Rossdhu, Luss, Dumbartonshire.
1870. WALL, G. Young, Land Agent, Grange House, Darlington.
1881. WATSON, Charles, Writer, Duns.
1871. WATSON, John, Gardener, Stravithie, St Andrews.
1879. WATSON, John, of Earnock, Hamilton.
1872. WATT, James, J.P., of Little & Ballantyne, Nurserymen, Carlisle.
1871. WATT, William, Forester, Nisbet House, Duns.
1874. WEBSTER, Angus D., Forester, Penrhyn Castle, Bangor, North Wales.
1872. WEBSTER, John, The Gardens, Gordon Castle, Fochabers.
1880. *Weir, George, Leith Walk Nurseries, Edinburgh.*
1866. WELSH, William M., of Dicksons & Co., 1 Waterloo Place, Edinburgh.
1882. *Wemyss, Baillie,* 23 *Brunton Place, London Road, Edinburgh.*
1882. WEST, J. R., Forester, Fonthill Abbey, Tisbury, Wilts.
1880. WESTWOOD, Wm., Manager, Belladrum, Beauly.
1881. *Whan, Alexander, Assistant Forester, Cally Mains, Gatehouse of Fleet.*
1881. WHITSON, A., Assistant Forester, The Nurseries, Rufford, Ollerton.
1883. WHITTON, Peter, The Gardens, Methven Castle, Perth.
1884. WHITTON, James, The Gardens, Coltness, Wishaw.
1884. WHYTE, John, Assistant Forester, Camperdown, Dundee.
1883. WILKIE, Charles, Assistant Forester, Lennoxlove, Haddington.
1875. WILKIE, Thos., Forester, Haddington Estates, Tyninghame, Prestonkirk.
1882. WILLIAMSON, A., Wood Manager, Eridge Castle, Tunbridge Wells, Kent.
1867. WILSON, John, Forester, Doonpark, Dalbeattie.
1871. WILSON, John, Forester, Greystoke Castle, Penrith.
1872. WILSON, John, Forester, Sudbourne Hall, Wickham Market, Suffolk.
1882. WILSON, Robt., Forester, Law's Cottage, Duns.
1883. WINNING, John G., Estate Office, Branxholm, Hawick.
1868. WYLLIE, George, Ballogie, Aboyne, Aberdeenshire.
1884. WYTON, William, The Gardens, Heysham Hall, Lancashire.

1875. YOUNG, William, Forester, Lennoxlove, Haddington.

ABSTRACT of the ACCOUNTS of the SCOTTISH ARBORICULTURAL SOCIETY for YEAR 1885-1886.

Branch	CHARGE.			
I.	Arrears of Subscriptions received,	£24	0	6
II.	Amount of Subscriptions received,	95	17	6
III.	Sums received for Life Membership,	19	19	0
IV.	Sums received for Advertisements,	35	19	0
V.	Dividend on Bank of Scotland Stock,	14	0	0
VI.	Received from School of Forestry Committee Sums paid for them,	21	13	6
VII.	Miscellaneous Receipts,	3	8	0
VIII.	Interest on Capital Account in Bank,	0	1	4
IX.	Balance of Operations on Current Account,	31	0	0
	Amount of Charge,	£245	18	10

Branch	DISCHARGE.					
I.	Prize paid in money,	£2	0	6		
II.	Salary to Secretary and Treasurer,	40	0	0		
III.	Accounts paid,	177	18	3		
IV.	Incidental Expenses,	11	15	3		
V.	Amount of Life Subscriptions paid into Capital Account, with Interest,	13	7	4		
VI.	Interest paid on Overdraft, National Bank,	0	1	6		
	Amount of Discharge equalling Charge,				£245	2 10
	Cash on hand,				0	16 0
					£245	18 10

STATE of the FUNDS as at 1st August 1886.

Sinking Fund, being price paid for £100 of Bank of Scotland Stock, and expenses of Transfer,	£327	5	0
Amount of Capital Account with National Bank,	18	2	0
Cash on hand,	0	16	0
	£346	3	0
Less overdrawn from National Bank,	17	9	7
Nett Funds of the Society,	£328	13	5

Edinburgh, 29th July 1886.—I have examined the foregoing Account of Mr John M'Laren, Junior, as *Treasurer* of the Scottish Arboricultural Society for year 1885-1886, and find the same to be correctly stated and sufficiently vouched. The total Funds of the Society are, as per State of Funds at close of this Account, £328, 13s. 5d.

JOHN ORD MACKENZIE, *Auditor.*

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